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First Diesel Electric Sidewheel Ferry

Oil Engine Operation of Converted Boat on the Ohio River Presents Many Advantages When Compared with Former Steam Power

AN important step in the progress of navigation on inland waters was made last month when the Diesel-electric sidewheel ferry FORMAN M. COOTS was christened by the Falls Cities Ferry & Transportation Company, operating between Louisville, Ky. and Jefferson, Ind. This installation is the first application of the Diesel electric drive to a sidewheel ferryboat and there are many interesting features connected with the arrangement of the equipment.

Oil engines enable the cost of ferryboat operation to be cut very considerably because of the nature of the service. Ferryboats, as a rule, operate on schedules such that the actual running time is about equal to the time at the docks. They operate in many cases all the year and for least 16 of the 24 hours in a day.

With steam equipment the cost of maintaining steam pressure at the dock ready for the next trip is nearly equal to the fuel actually consumed during the run. Even with fairly efficient steam equipment the cost of fuel due to this standby loss is out of all proportion to the horsepower-hours developed.

This one factor accounts to a large degree for widespread interest in Diesel drive for ferryboats. The Diesel engine can readily be started and stopped, so that the fuel consumption at the dock ceases entirely. Or if the time of the stop is short the idling engine consumes a small amount of fuel due to the high thermal efficiency of this type of prime mover.

There are also other reasons than fuel saving which make the Diesel engine attractive for ferryboat work. In the first place the labor for firing the boilers is eliminated, and one engineer can easily handle a boat equipped with two engines. Secondly, the Diesel drive eliminates the smoke and soot which accompany the operation of the steam plant, adding to the comfort of the passengers and reducing the cost of maintaining the boat in a clean condition.

These considerations led to the decision to convert the FORMAN M. COOTS, formerly operated with steam equipment under the name of WILLIAM S. MCCHESNEY. The hull was built by the Howard Ship Building Company of Jeffersonville in 1913 with a length of 172 ft., a beam of 45 ft., depth 7 ft., draft 30 in. and tonnage of 490 net. The boilers were formerly located on the main deck and the engines in the hold. The space occupied by the boiler installation was laid out to take care of the new engine room, with the space in the hold for the auxiliaries.

After careful consideration it was decided to install two Diesel engine units of sufficient size to enable one engine to operate the ferry for ordinary schedule and ordinary stages of the river. Two Fairbanks, Morse engines, each rated at 240

Converted sidewheel ferry, now equipped with Diesel electric machinery, operating on the Ohio River between Louisville and Jeffersonville

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b.hp. at 257 r.p.m. were installed. These are 4-cylinder engines of the two-cycle, airless injection type, each direct connected to a General Electric Company 175 kw. 230 volt, 760 ampere, compound wound, direct current generator furnishing current for the main motors, electric auxiliaries and lighting.

Each of the two sidewheels, which are 24 ft. diameter and 10 ft. wide, with 24 in. paddles, are driven by 175 hp., 425 r.p.m., 230 volt, shunt wound, direct current motors, geared to the side wheels as shown in one of the illustrations.

Complete control of the electrical equipment is centered in the engineroom switchboard, made up of three panels. The center panel is provided with the necessary equipment for controlling the voltage of the two generators, switches for disconnecting the generators from the motors and for connecting the two motors across either generator. At the left is the controller by which the engineer can regulate the speed of the main motors driving the paddle wheels. Another of these controllers is located in the pilot house, the pilot ordinarily having complete maneuvering control of the ferry from that location. It it should be desired, however, to transfer to engine room control, it is only necessary to throw two switches. The pilot then signals the engineer in the usual way.

The switchboard busses and switches are so arranged that it is possible to secure several combinations of energy supply. When both generators are operating each one drives its own motor, or each generator can drive both motors. The generators are not arranged for parallel operation, because the independent drive arrangement was considered to be more flexible and to offer a greater factor of safety.

With the exception of a small air compressor, all of the auxiliaries are electrically operated. The fire pump, air blower for blowing air on the commutators of the main motors, sanitary pump, steering motor, motor generator set for 110 volt lighting, bilge pump and electric air compressor for supplying starting air for the Diesel engines are handled from one panel of the board.

Another feature of engine equipment in line with the latest practice is the use of pyrometers for determining the temperature of the exhaust. A thermo-couple is located in each exhaust pipe and a multiple point switch placed on a small panel at the end of the engine is used to cut any one of the thermo-couples on to the indicating pyrometers on the center panel of the switchboard. It is therefore possible for the engineer to keep an accurate check on the operating conditions in the cylinders.

The engines are equipped with speed regulators so that it is possible to slow them down while at the dock if desired. The hand wheels seen on the end of the engines regulate the governor setting.

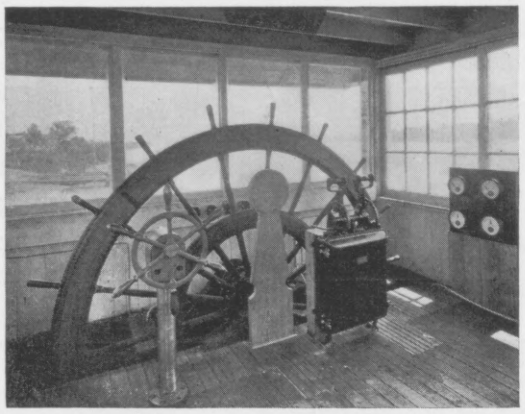
Due to the feasibility of locating the engines on the main deck it was possible to provide a light and airy engine room with windows all around. It is constantly under observation by the passengers, and there is every inducement to keep it spick and span.

One of the points which impresses the observer of this ferry in operation is the complete absence of signals to the engineer. The boat docks without a sound except the muffled exhaust of the engines. This has been achieved by the scheme of pilot house control previously mentioned.

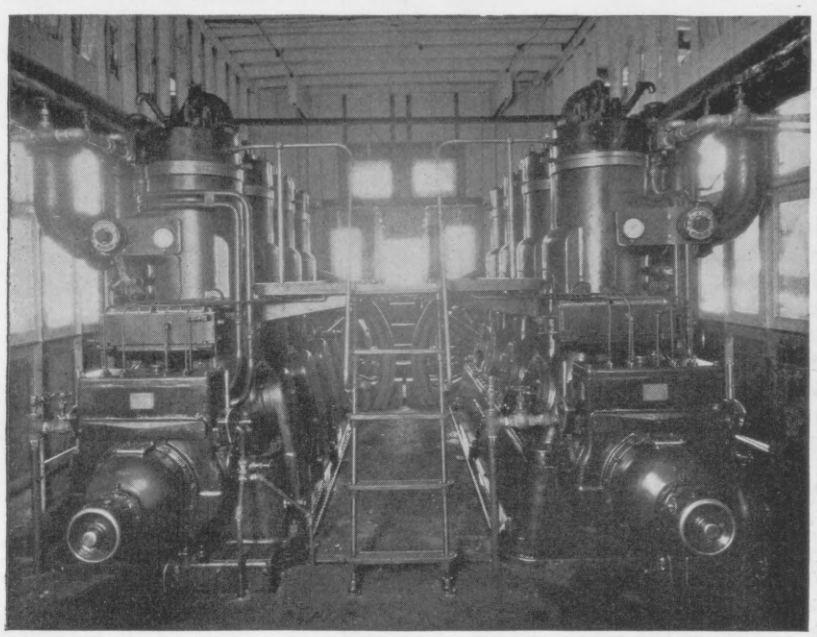
From the illustration of the pilot house it will be noticed that a controller has been placed adjacent to the steering wheel. The two levers regulate the speed of the motors so that the pilot has complete control in maneuvering. This works out so thoroughly that it is actually possible to handle the steering by means of the side wheels. In one of the trial trips while the tiller rope was being changed the pilot handled the ferry without the rudder and made landings without difficulty. The small wheel shown in the pilot house controls the steering motor. The instruments on the panel at the right indicate the load on each motor and the speed of the paddle wheels in revolutions per minute.

The service trips already made with this ferry have demonstrated that it will be operated at a low fuel and labor cost, that the cleanliness—due to freedom from smoke and soot—is appreciated by the passengers and that the quick response with pilot house control is a decided advantage.

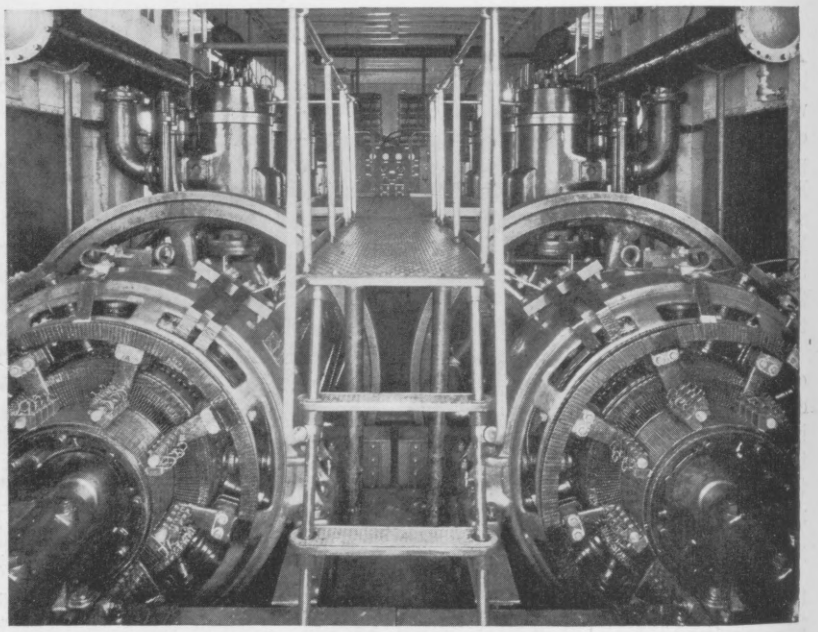
The engineering work connected with the installation of this Diesel-electric drive was worked out by Wm. A. Ingram, engineer of the Falls Cities Ferry & Transportation Company in conjunction with the Fairbanks-Morse and G. E. engineers.



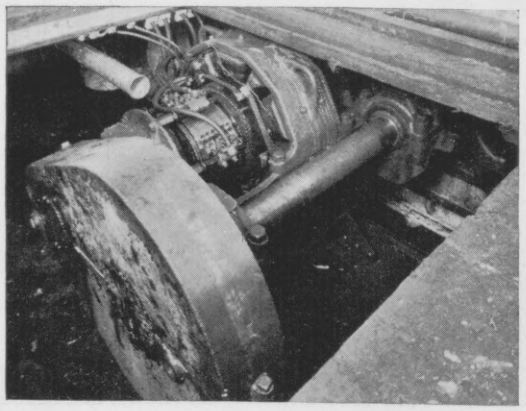
Pilot house with machinery control.



View of engines lighted through deck windows.



Engine room view under artificial light.



Gear drive to sidewheels.

The cash prize of 4000 krone (about $750) for the best design of ferry for use in Danish waters was won recently by Aage Larsen, chief engineer, and H. C. Holst of the Danish Government Railroad System. The design shows a Diesel-driven ferry with three railroad tracks and of such a shape that the ferry has a sharp stem although the stern is very broad. There is a possibility that some of the present boats will be converted from steam.

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Towing Log Booms with Small Motor Tugs

Small Western Craft Struggling with Immense Log Booms at Low Speeds Have Special Propeller Problems

HARBOR tugs of the Pacific Northwest, of which oil-engined craft now form a large proportion, have probably the heaviest tows of any of their class to handle as a steady pull. The ordinary harbor tow, consisting of vessels, barges or scows, when once started moves along readily at a speed of 3 to 6 knots, but the booms of logs cut from the exceptionally heavy timber of the western slopes of the Pacific Coast ranges tax the little craft severely, because 1½ to 2 knots is about the best speed that can be made with the average boom.

Booms are usually made up between sticks held in position by rows of piles about 60 ft. apart, though some booms are made as wide as 80 ft. The logs are floated in between the boom sticks and packed as tight as they will fit, in order to tow end on. A "swifter" log is then hauled across the top of the boom by a donkey engine and securely chained to the boom sticks at either side. Swifters are placed at intervals of 50 or 60 ft., corresponding with the length of the boom sticks on either side. The number of sections in the boom is counted by these swifter sticks, and while the number of feet (board measure) to the section varies according to the size of the logs, about 40,000 ft.b.m. of logs to the section is regarded as a far average.

Large tugs bring booms of 25 to 50 sections down the coast, and in many cases give them to harbor towboats for distribution to the mills in tows of 10 to 20 sections, for convenience in taking them through bridges and yarding into the mill booming grounds, where the water is often too shallow for the larger tugs to work.

Motortug Radio towing 18-section log boom up False Creek, Vancouver, B. C.

In the Vancouver oil engined tug boats of 40 to 60 ft. overall the working out of towing propellers that would efficiently deliver the engine power at speeds of one to two knots when direct connected to Diesel and other types of oil engines turning at 300 to 400 r.p.m. has proved quite a problem. Most of the pioneer oil engined towboat owners of Vancouver have achieved satisfactory results only after experimenting with several wheels.

H. Bruno's tug PROSPECT POINT, 42 ft. o.a. by 10 ft. 11 in. beam, furnished an interesting example of propeller experiments. She is equipped with a 3-cylinder Wolverine Diesel rated 70 b.hp. at 350 r.p.m. This tug was first tried out with a normal 3-blade propeller of 44 in. diameter and 36 in. pitch, which turned up at the full 350 r.p.m. with the tug running light on her trials and drove her at 9.25 knots. It was apparently an efficient wheel under these conditions, but when the tug made fast to a heavy tow of logs Mr. Bruno says that the engine speed came down to about 250 r.p.m. The engine was being overloaded and in spite of this was evidently not delivering the power it should. Several propellers were tried out with less pitch, and one with 2 in. less diameter as well. The present wheel of 44 in. diameter and 28 in. pitch is said to give satisfaction turning at 310 to 320 r.p.m. when towing logs. PROSPECT POINT is largely used towing between booming grounds on Burrard Inlet and saw mills on False Creek, another branch of Vancouver harbor. This means running through First Narrows where a 6 to 8 knot tide frequently develops tide rips on the ebb when it meets a wind and swell from the open bay. Logs are often lost here by tug boats, and a very able boat as well as good judgment on the part of the Captain are required to take these slow moving tows around craft.

The small and handy oil engined craft, with large power for their size and the ability to start out for a tow on very brief notice, have been multiplying rapidly at Vancouver, and having demonstrated their reliability are making large inroads on the business previously in the hands of the steam tugs and a few small gas boats.

Capt. J. A. Cates' tug RADIO has worked out very satisfactorily on heavy tows during the past two years. She is 55 ft. o.a. by 14 ft. beam and 7 ft. 10 in. draft, and is heavily constructed of fir with sawed frames. RADIO is equipped with a 4-cylinder Atlas-Imperial Diesel developing 90 b.hp. at 300 r.p.m. She is largely used for towing logs, frequently taking booms from the larger tugboats in English Bay and towing them through the bridges into False Creek, handling up to 18 or 20 sections of log in one tow.

A 3-blade wheel of 55 in. diameter and 36 in. pitch was tried out and gave satisfactory results turning at 285 r.p.m. when towing logs and 310 r.p.m. when running light. This wheel, however, was knocked out of business by striking a sunken pile or driftwood and a 3-blade wheel was put on with a diameter of 52 in. and 40 in. pitch. This wheel apparently had a little too much pitch, the revolutions being lowered to 275 when towing. The latest wheel for this

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tug is a 3-blade propeller of 53 in. diameter and 36 in. pitch.

The tug RADIUS, which Capt. Cates added to his fleet about a year ago, is 60 ft. o.a. with 14 ft. molded beam and 8 ft. draft. She is also heavily constructed, and is equipped with a 3-cylinder Atlas-Imperial engine developing 125 b. hp. at 265 r.p.m. The first wheel used on the RADIUS was a 3-blade of 55 in. diameter and 37 in. pitch, but the engine is said to have run away with it, having to be throttled down after turning up 350 r.p.m. Another wheel was then secured, having 59 in. diameter and 43 in. pitch, which is reported giving very satisfactory results. With the tug light the engine is said to run at about 300 r.p.m., and on a heavy tow of logs turns at 270 r.p.m., making a speed through the water of 1 to 1½ knots. This speed is slightly higher than the rated speed at which the engine develops its designed horsepower, and though the engine cannot be utilized to the best advantage for running light it is doing its utmost on the heavy tow, when the power is undoubtedly most needed.

Another very successful towing propeller is reported in use on the Powell River Co.'s tug TEESHOE, 56 ft. o.a. by 14 ft. beam, equipped with a 3-cylinder Union Diesel, rated 110 b. hp. at 280 r.p.m. This wheel is said to be 58 in. diameter by 36 in. pitch. The engineer states that it turns at 280 r.p.m., with something to spare, on heavy tows of booms. This wheel was considered so satisfactory that when it was badly bent by striking a submerged obstruction, another wheel of exactly the same size was ordered to replace it.

The Vancouver Tug Boat Co.'s tow boat

Radius towing 9-section log boom through bridges on False Creek, Vancouver

ATTA BOY, 58 ft. o.a. by 13½ ft beam, equipped with a 4-cylinder Washington Estep Diesel rated 100 b. hp. at 325 r.p.m., is using a 3-blade wheel of 54 in. diameter and 34 in. pitch, which is said to turn at 325 r.p.m. towing heavy dump scows when working as a dredge tender.

The Pacific Tug & Barge Co.'s new oil engined tug PACIFIC FOAM, 54 ft. o.a. by 14 ft. beam, equipped with a 4-cylinder Fairbanks, Morse oil engine rated 100 b.hp. at 340 r.p.m., is reported to be getting a 3-blade wheel of 52 in. diameter and 33 in. pitch to replace the first wheel, which was unsatisfactory.

Besides those mentioned, a number of other small tugs, using various makes of Diesel and oil engines, are finding effective propellers for the particular towing on which they are principally engaged.

Opening of the New York State Barge Canal was earlier this year than it has been in the last 40 years. It was opened to traffic on April 22, and the first month's operation showed a greater tonnage passing over the waterway than has ever previously been recorded.

An iron foundry with an electric furnace specializing in the manufacture of high grade castings of smaller sizes particularly for oil engine work was installed at the Cramp plant at Philadelphia last year.

On the yacht building for George W. Childs Drexel, two small oil engine generator sets are to be installed, one of 4 kw. capacity and the other of 8 kw. These will both be of the Hill Diesel type.

Harland & Wolff have delivered to Andrew Weir & Co. (The Bank Line) another unit of the large motor fleet building for those owners. The latest vessel is the ELMBANK which closely resembles the other twin-screw motorships recently delivered, having a gross tonnage of about 5200.

Alfred Holt & Co. of Liverpool, have taken delivery of the motorship PEISANDER, a vessel of about 8220 tons gross with twin-screw machinery of about 3700 s.hp. built by Burmeister & Wain of Copenhagen. Four auxiliary Diesel generators each of 100 kw. capacity are provided for the electrical service of the ship.

Five steamers owned by the Societa Commerciale de Navigazione are to be converted to Diesel power. Four of these vessels will have Fiat engines of 2200 s.hp. each in place of the Tosi reduction gear turbines now installed. The fifth vessel is an American-built ship which has been transferred to the Italian flag, and she also will have a Fiat Diesel engine.

Japanese motorships will make a regular call at the port of Los Angeles in future. Three new motorvessels of the Osaka Shosen Kaisha which are to be used in round-the-world service will make the Los Angeles call. They are the MANILA MARU, HAWAII MARU and another unnamed.

Italian motorships are to be placed on a new service between Pacific Coast ports and the Mediterranean. The new vessels building for the Societa Navigazione Libera Triestina are to start the service this summer, sailing from the Adriatic and calling at Italian and Spanish ports. The sailings will be inaugurated by the LEME; the FELLA will follow one month later. The names of the other boats are not yet known. These vessels are all of about 9300 tons d.w. with a speed of about 10½ knots. The engines are of 2700 i.hp., of the Burmeister & Wain type built by the Stabilimento Tecnico Triestino. Pacific Coast calls will be Los Angeles, San Francisco, Columbia River, Puget Sound and British Columbia ports.

The West Australian government is calling for tenders for a Diesel engined vessel for service on the northwest coast of that Continent. An appropriation of $777,600 has been made.

A rotor vessel of about 3000 tons d.w. is to be ordered by the Germany Navy in cooperation with the Union of German shipowners, according to current rumors in Hamburg.

A consideration of the lubrication of 4-cycle oil engines fills the April issue of *Lubrication*, which is the house organ of the Texas Company. A copy can be obtained by writing to L. A. Jacob at the Texas Company's office 17 Battery Place.

Centrifuges for the purification of both fuel and lubricating oil are to be installed in the motorvessel now building at the Fairfield Yard in Scotland for Houlder Bros. of Liverpool. The centrifuges are of the Vickcen type manufactured by a subsidiary of Vickers, Ltd.

Owing to the strike in the Danish shipyards the second double-acting engine for the new Swedish-American liner GRIPSHOLM has been still further delayed.

MONTE OLIVIA, a sister ship to the MONTE SARMIENTO described in the February issue of MOTORSHIP, has been delivered to the Hamburg South America Company.

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Motor Vessels on the Chinese Rivers

Present and Potential Development of Oil-engined River Craft on the Great Inland Waterways of China.

By Jeannette F. Edwards

THERE are unlimited possibilities for the Diesel engine in the Yangtse River valley—and the field is practically untouched. China has a great system of internal water-ways. The greatest of all is embraced in the Yangtse River valley. From the sea to Hankow, a distance of nearly 600 miles, the slope of the river is very gradual. In this section tributary streams, canals, and lakes furnish means of transportation by native junks, reaching out into Hunan, Kiangse, Chekiang and Kiangsu provinces, distances of 200 miles and more.

In Eastern Kiangsu and Chekiang provinces the canal system totals over 10,000 miles in length, with a minimum width of about 12 ft. and depth of water of about two feet. Although the Yangtse river below Hankow is navigable nine months of the year for large ships of 25 to 30 ft. draft, and at lowest water for ships of 10 to 12 ft. draft, many thousand sailing wooden junks transport by far the greater part of the freight, and the cost of operating the junks controls the freight rates.

The Yangtse River type of junk, as may be noted from illustration, is not adapted to machinery propulsion.

The thirty to forty ships of 1,000 to 3,000 tons displacement regularly playing between Shanghai and Hankow and Ichang, a distance of nearly 500 miles, are all steamers. Those less than about 30 years old have been built and engined in the docks of Shanghai, Hongkong and Japan, where experience in building and maintaining Diesel engines has been practically nil.

The designers and constructors of these ships are for a large majority Scotch engineers, in whose original training and experience the Diesel was not a factor.

These steamers are designed on an average for 15 knots speed. They make that coming down river with the current, and 10 or 12 knots going up. Their power requirements, therefore, are well within the range of greatest experience with Diesel-engine driven ships.

Coal costs approximately $5.00 per long ton and fuel oil of 70 to 80 per cent greater heating value costs approximately $15 per ton at Shanghai.

The ships are under way about 50 per cent of the time, due to the number of ports of call and methods employed in handling cargo. At the present rate of increase in trade the ships now in operation have capacity for the steamer freight traffic for probably four years in the future. Only substantially lower operating costs would materially reduce the amount of freight now carried by native junks.

Other than the river ports, there are many commercially important cities connected with the river by canals of a minimum depth of five feet, where steam launches or tugs are employed by passengers and faster moving freight. These launches have about 100 hp. on an average. Equipment and hulls, engines and boilers were built in native shipyards by Chinese whose knowledge and skill was originally gained through the training of the Scotch engineers and Chinese ship foremen in the foreign shipyards of Shanghai.

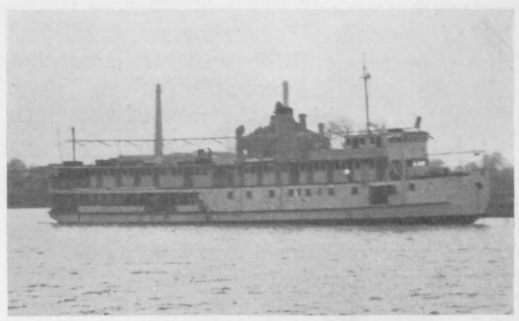
A few of these launches have been equipped with American, British, German, Swedish or Swiss built surface ignition engines, but the lack of experience of the native shipyard mechanics with these engines and the lack of precision in machine-shop tools have been contributing causes to

Sampans on river at Shanghai

the economic failure of these experiments. Diesel fuel oil has not been stored and sold competitively in the Yangtse valley until quite recently.

Above Ichang, in Hupeh province, the river flows through gorges, and the slope is sufficient to cause rapids of a velocity of 10 knots. Safety in navigation necessitates ships being powered for a speed of 15 knots or greater.

Good steam coal is not available from sources above the rapids, and the large proportion of bunker space required materially



Yung Ning, up-river Diesel boat

affects the freight capacity of the limited size of ships suitable for this run. As this section of the river constitutes the main highway of communication with the rest of the world for 20 per cent of the population of China and is one of the most fertile provinces, the Diesel-engined ship has a unique opportunity in solving this difficult problem in a great transportation need.

In that section of the Yangtse from Ichang to Chungking, a distance of 400 miles, there are three gorges famed for their danger and some 60 rapids and whirlpools which render navigation extremely difficult and exciting. Up to 1898 no steamer had ever attempted to go through. Then one hardy pioneer, Archibald Little, who wrote a book on his experiences, dared it. A few gunboats went through in the following 10 years. The first commercial steamer began to ply regularly in 1909.

The next step was the motorship, which has been in use there for over three years and still seems almost a miracle. Just the other day an old China hand, a skipper who ought to know Chinese shipping inside out, fairly roared at the idea of a motor ship passing the rapids.

"Not one has ever been through to the up-upper river," said he, "unless she sat on the deck of a steamer!" We had quite an argument about it, which only the statistics settled.

Barry and Dodwell, a British firm, were the first who had the pluck to try it. They sent the first motorship through the rapids in 1921. She was the CHWANG NAN, built by the Kiangnan Dock and Engineering Co. and used for both freight and passengers. Her dimensions are 72 ft. by 15 ft. by 5 ft. Her sister ship, the CHWANG TUNG, soon followed and then the CHWANG HSI, 111 ft. by 18 ft. by 6 ft. Barry and Dodwell are now building a fourth one for this service with a Vickers-Petters engine.

Other "upper river" motorships that brave the gorges are: PING HUO, 115 ft. by 21 ft. by 5 ft. and TAI LAI, 90 ft. by 18 ft. by 4.6 ft.—both owned by Tamborini and Co., locally built; LUI WAH (90 ft.), SHU NAN (154 ft.), YANGTSEKIANG (120 ft.), KINGSHAKING (95 ft.) and PING AN (110 ft.)—all owned by the Swedish Trading Co. The LIN WAH is another, just launched, equipped with surface-ignition engines and Chinese-owned.

None of these ships uses American engines, but most have oil engines of the Diesel type. Several more are under construction for the same run, which is Chungking to Suifu in summer and Chungking to Ishang in winter.

"Personally," said a member of the firm of Eisler, Reeves, Murphy, and Tipple, Ltd., naval architects, "I prefer steam. Motors are risky, the rapids are no place to be playing the fool; what you use must be reliable. To 'heave through' the rapids, these vessels are fitted with sheaths on the bows; a wire is made fast to a rock on shore; the ship is assisted by shearing. However, the beginnings of any enterprise are risky."

A typical example of the up-river steamer is the new YUNG NING, lying in the Whangpoo, Shanghai, ready to start on her first trip the week after I saw her. Through the courtesy of Mr. Groat, wharfinger of the Robert Dollar Wharf—who acted as host when I called there, in the absence of F. R. Palmer, manager or "shore Captain" for the Dollar shipping, Shanghai—I was loaned a motor launch, enabled to go aboard the "Yung Ning," examine her and take photos. Mr. Groat also had me conducted

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on a tour of the interesting Dollar plant, but that is another story.

The YUNG NING is 137 ft. by 25 ft. by 10 ft., equipped with three Diesel engines, triple-screw, 200 hp. each. She carries 200 tons of cargo and has accomodations for 10 first-class passengers, 42 second class, 60 third class and 44 steerage. Her fittings are luxurious: pretty, airy dining saloon, smoking room done in mahogany and tapestry with easy-chairs. Her run is Ichang to Chungking, and the trip, made on her, would combine thrills with comfort.

In the Canton delta is the second important system of internal waterways. Only about 80 miles of the Pearl River there is navigable for steamers of 10 ft. draft. Above Canton there are extensive waterways, serving an intensively cultivated, densely populated district. The internal combustion engine has been employed here in much greater proportion to the steam engine for launches and tugs of an average power equipment of 100 hp. capacity than in the Yangtse.

In the early years of this development British manufactured surface ignition and electrical ignition heavy-oil and kerosene engines were used. As the necessity for repair shops increased, and the replacement of parts was undertaken, local shops gradually built all of the parts and are now building complete engines of the types of the most popular imported engines. These locally made engines are sold at prices much lower than any European or American ones. They are now being used almost to

Yangtse junks at Shanghai.

the exclusion of all the foreign-built engines.

These are the important shipping channels in China. On the various other rivers motorships and steamships are of relatively minor importance for freight and passenger transportation.

Speaking of China as a whole, Americans have scarcely a foothold in the field of marine engines. The American reader will ask why?

1.—The others were in the field first. Jardine Matheson, the great British shipping firm in the Far East, got in 50 years ahead of us. Builders of other nationalities are selling through them and through other well-established houses here, which get business through their Chinese compradores that a newcomer can't get hold of.

2.—Money is tight. Local sales are cash-on-delivery, at varying discounts. But the money isn't here. Until China has a stable government no foreign concern wants to put much money into enterprises here. The big tobacco and oil companies go on of course; their products seem necessities, but machinery is not.

3.—Labor and time are cheap. It doesn't matter how long cargo takes to get anywhere or how many coolies die in hauling a junk through a canal.

4.—American-made engines are criticized here because of fluctuating price, difficulty of getting spare parts, ease with which cylinder blocks crack and high fuel consumption. British and Swedish makes are gaining on ours.

Yet—China's great natural resources are practically untapped, especially those products away from the seaboard. They must and soon will be brought into the world's market. China is undergoing great industrial changes. There is, potentially, an enormous market for large heavy-oil engines. Why aren't we in it?

The writer is indebted to Hollis H. Arnold, American engineer and resident of Shanghai for many years, for a general survey of the river-shipping in China.

The present fleet of 40 steamers on the Upper Yangtze will be augmented by 15 new boats in 1925, according to a recent report from R. L. Smyth, vice-consul at Chungking. A list of the boats in the fleet may be obtained from the Transportation Division of the Bureau of Foreign & Domestic Commerce, Department of Commerce, Washington, D. C.

Basis of Measurement for Panama Canal Tolls

ITEMS recently appearing in many of the daily papers and in practically all periodicals dealing with marine matters indicate such entire misapprehension of the intention and effect of proposed legislation basing tolls upon Panama Canal rules of measurement only, that it seems desirable that those interested be correctly informed.

The present situation is that, due to the Attorney General's decision as to the meaning of certain language in the basic Panama Canal Act, all vessels must be measured both by Panama Canal rules and by the United States rules for measurement of vessels. Then, applying the rates of $1.20 per ton Panama Canal rules and $1.25 per ton United States rules, the vessels pay which ever results in the smaller tolls bill.

This double system of measurement is not only a considerable administrative difficulty for the Canal authorities, but the use of the United States rules as interpreted by the Commissioner of Navigation results in additional embarrassment, since all changes made by him from time to time in his interpretations must apply at the Canal, often resulting in vessels having considerable variations made in their tolls bills in consecutive trips through the Canal, when no change whatever may have been made in the ship itself or in the rates for tolls. This variation in tolls without any apparent reason, is difficult to explain to shipowners, especially to those of foreign flags.

Furthermore, vessels of almost identical construction and of identical carrying capacity are rated differently as to net tonnage because of slight differences in the size of openings, in arrangement of fuel pumps, or other differences not connected with the carrying capacity of the ship. Illustrative of this is the case of the GOLD SHELL and the SILVER SHELL, two ships of exactly the same dimensions and the same cargo carrying capacity, the former paying tolls of $4,386.25 and the latter $5,076.25, for no other reason than that there is a difference in location of a small fuel transfer pump.

Another illustration of the absurdities due to the present method of measuring net registered tonnage is the case of a ship recently transiting the Canal, where the Captain forgot to carry into effect orders which he had received to knock the cleats off a certain opening and had to pay an additional $1200 toll because of such forgetfulness. In other words, this ship could have benefited to the extent of a $1200 reduction in tolls by having these cleats removed, although the cargo was actually in the compartment, and whether cleats were there or not had no effect upon the carrying capacity of the ship.

The Panama Canal administration has been endeavoring for some years to have the Panama Canal rules made the sole standard of measurement. Should these rules be applied without any change in present toll charges, the result would be a considerable increase in the collection of tolls, and, consequently, there would result a heavier burden on shipping. Realizing the objection to this increase, it is proposed that, if the bill adopting the Panama Canal rules as the sole basis of measurement becomes a law, the President will be asked to issue an Executive Order reducing the rates to $1.00 per ton loaded and 60 cents per ton in ballast, to be effective as soon as the above legislation becomes operative.

Instead of the proposed change putting an additional burden of several million dollars on shipping, definite calculation shows that during the last fiscal year the Panama Canal would have collected $494,357.54 less in tolls than under the existing double system of measuring ships, and that for the first six months of the present fiscal year this reduction in tolls would have amounted to $50,053.21.

The Panama Canal rules, prepared by Dr. Emory R. Johnson, Dean of the Wharton School of Finance and Commerce, University of Pennsylvania, are believed to provide a much fairer index of a vessel's earning capacity than the United States rules. It is quite true that if the change is made some individual ships will pay somewhat higher tolls than they do now, but the general effect upon shipping is a slight reduction in tolls, and it is believed the opinion of shipping men as a whole, if they will inform themselves as to what is proposed, will be favorable to the legislation asked.

M. L. WALKER,
Governor, The Panama Canal.

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Motorships Invade the Oriental Trade

After a Slow Start the Japanese Shipping Interests Make Rapid Progress with Diesel Engined Vessels

By E. R. Dickover*

PRIOR to 1924 there were no motorships, other than fishing vessels, in operation under the Japanese flag. During the period between January 1, 1924 and November 31, 1924, four motorships aggregating 10,800 gross tons, were constructed for Japanese account. On December 1, 1924, 12 vessels with a gross tonnage of 43,350 were under construction in Japanese yards for native account, of which total one vessel of 6100 gross tons was to be propelled by Diesel engines. On the same date contracts had been placed by Japanese owners with native yards for the building of 13 vessels totalling 50,360 gross tons, four of which are to be motor ships with a total gross tonnage of 27,500. In addition two twin-screw liners built in Scotland were delivered to Japanese owners during the month of December, 1924.

The above figures, embracing ships of 1000 tons or over, have been furnished by the Kobe Shipping Exchange in the absence of complete official returns, and are considered reliable. Mention must also be made of 3 Diesel-engined twin-screw passenger ships, each of 688 gross tons, of Japanese registry, which have not been included in the above summary on account of their small size. Further details regarding these motor ships and all others will be found below.

These figures indicate the extent to which the Diesel type of heavy fuel internal combustion engine has been adopted by Japanese shipowners. In the course of two years Diesel engines have displaced steam engines as the favored means of propulsion in new Japanese tonnage.

It should be noted that the adoption of the Diesel engine is confined to five of the larger Japanese shipowning firms, and the remaining shipowners have pursued the policy of buying vessels of varying ages and types of other nationalities and transferring them to Japanese registry, or, in some cases, are having new steamers built. These latter shipping companies have neither the sea-going personnel nor the technical staff necessary for the operation of motor ships and, apparently, are taking no steps toward the development of their organization in this respect.

On the other hand, the companies which are adopting the Diesel engine have sent men abroad for the purpose of studying the construction and operation of this type of engine at European plants.

Another feature of Japanese motor shipping is that only one of the nine motor ships built or building is fitted with an engine built in Japan. Also, only one of the four motor ships recently ordered will be driven by a native built engine. The hulls of all motor ships were built or are to be built in Japan, with the exception of the two vessels constructed in Scotland. Accordingly, of the 13 motor ships listed, nine are engined or to be engined by machinery built in Europe but installed in Japan. The engines built in Japan have been constructed under licenses held by Japanese yards. No Diesel engines of native design have been evolved as yet. It must be kept in mind, however, that the information contained in this letter is based on available facts in connection with merchant shipping, and that conditions in the Japanese Navy are not described on account of lack of definite knowledge.

It is said that up to the last few months building costs were higher in Japan than in Europe, with the result that Japanese yards could not compete with foreign manufacturers. While the continued decline of the yen has rectified this handicap, nevertheless, it appears that certain Japanese companies are able to obtain loans for the building of motor ships more cheaply in Europe, on condition that the vessels are built in Europe.

Japanese yards have had to adapt their technical staffs, personnel, and equipment for the manufacturing of Diesel engines, and this may account for their inability to compete with foreign makers in the matter of price and workmanship.

These handicaps are not fixed and can be adjusted by the Japanese themselves, because the larger shipyards are affiliated with the leading shipping companies and in several cases are controlled by the majority shareholders of the large general trading firms and leading banks.

The large motor ships built for Japanese account during the calendar year 1924, were as follows:

M. S. AKAGISAN MARU, owned by the Mitsui Bussan Kaisha, has a hull built by the same firm at their Tama yard, but the engine of 1800 b.hp. was built by the B. & W. Company at Copenhagen, Denmark, and shipped to Japan for installation. The vessel is a single-screw freighter with a gross tonnage of 4630, and a deadweight capacity of about 7100 tons. It is being operated on the North Pacific route.

FUKKO MARU is a motor ship owned by Teikoku Kisen Kaisha, and has the distinction of being the only motor ship entirely built in Japan, the hull and engines having been constructed by the Kobe Steel Works at its Harima yard. The vessel is a single-screw freighter having a deadweight of about 6000 tons and is fitted with engines built under Sulzer-Winterthur license, developing 1600 b.hp. At the present time the ship is being operated in the "Near Sea" service.

M. S. KURENAI MARU, owned by the Osaka Shosen Kaisha, is equipped with engines built by B. & W. in Denmark, the hull being built by the Osaka Iron Works at Sakurajima, Japan. This vessel is a twin-screw passenger ship with a gross tonnage of 1550. The engines develop 2100 i. hp., giving the vessel a sea speed of 13¾ knots. It is being operated on the Osaka-Kobe-Beppu line.

The Osaka Shosen Kaisha also owns the M. S. ONDO MARU, a twin-screw passenger ship with hull built by the Mitsubishi Zosen Kaisha at Kobe, Japan, and equipped with engines built by Vickers in England, but installed in Japan. Its gross tonnage is 688, and the engines develop 600 b.hp. The vessel is being operated on the local Inland Sea service.

The following motor ships were under construction in Japanese yards on January 1, 1925:

M. S. FLORIDA MARU, owned by Kawasaki Kisen Kaisha, is being built by the Kawasaki Dockyard Company at Kobe, but will be fitted with a 2500 b.hp. Cammel-laird-Fullagar engine built by John Brown & Co. at Clydebank. The deadweight capacity of the vessel is about 9700, and after completion of trials, this single-screw freighter will be placed in the round-the-world service maintained by the owners in conjunction with the Roosevelt Steamship Company of New York. It is expected that the vessel will be ready for service in the early part of 1925.

The motor ships MIHARA MARU and HAYATOMO MARU are sister ships to the ONDO MARU which has already been described. The particulars, owners and builders of hull and engines are identical for the three ships. These latter two ships will be ready for service in the spring of this year.

In addition to the vessels built or building, as described above, the following motor ships have been contracted for, and keels will be laid during the year 1925.

A sister ship to the M. S. FLORIDA MARU is to be constructed at the Kawasaki yard at Kobe, for the same owners and service as the FLORIDA MARU. The keel of the vessel is to be laid shortly after the delivery of the FLORIDA MARU.

The Nagasaki yard of the Mitsubishi Zosen Kaisha has received orders for the construction of 3 sister motorships for the account of the Osaka Shosen Kaisha. They are to be twin-screw vessels of about 10,000 tons deadweight, and their engines are to develop 4500 b.hp. Two of the engines will be furnished by Sulzer of Winterthur, while the third vessel will be engined by the Nagasaki yard under their license.

In addition to the motorships built, building or to be constructed in Japan, two vessels were constructed in Scotland for the Nippon Yusen Kaisha and delivered to the owners in December, 1924. These vessels have been named the ASUKA MARU and the ATAGO MARU, and are twin-screw freighters with a gross tonnage of 7560 each and deadweight of 10,000 tons. The engines of each vessel develop 4000 b.hp. and the indicated horsepower is estimated at 6000.

In giving the above particulars, details regarding the engines have been omitted, as they are of standard types, the specifications of which are readily available.

*American Consul in Charge, Kobe, Japan.

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Engines Should Adapt to Changes of Fuel

Future Oil Conditions Suggest That Marine Engines Should Not Be Dependent Upon Single Grade of Fuel

A BIG ocean-going vessel under American management recently experienced engine trouble through a cause that seems incredible until it is explained. The machinery had been operating with entire satisfaction on a low grade of fuel. One day, when she had to rebunker, the chief engineer was informed by the contracting oil company that there was no low-grade fuel in stock at that particular port on that particular day, and the company would therefore supply him with a much better grade of fuel at the contract price.

This proposal looked very attractive to the chief, and he gladly accepted the offer. His delight, however, was short-lived, because the ship was scarcely at sea before trouble was experienced with the injection valves. Examination showed that the trouble was at the fuel nozzles, which had to be replaced at very short intervals. The only possible conclusion was that the new fuel was responsible. The trouble became so pronounced that the ship was forced to put into another port, have her fuel tanks pumped out and a low-grade oil substituted. When the trouble was explained to the oil company, the most of the second bunkering was not charged to the vessel.

This happening has again emphasized the need for provision to be made on ocean-going ships to enable the engineer to adapt his engine to different grades of fuel. The benefit to the operators will be very great. It will enable them to bunker in any port without delay and without regard to prevailing conditions in the oil business.

It is almost ludicrous that engines which are operating with entire success on low-grade fuels should give trouble when supplied with considerably better fuel. The fault is not with the engines nor with the operator, nor with the oil company, but is due entirely to the fact that means of adjustment have not heretofore been considered necessary.

Conditions in the oil world are changing, and the conditions of motorship operation are changing at the same time. When motorships first appeared on the ocean they were not numerous enough to be trading to all parts of the world, but were operating on only a few routes, and the provision of what was considered the most desirable fuel presented no difficulty.

Engine builders always have preferred that their engines should operate on a fuel of the gas oil grades commonly known as Diesel oil. There was no difficulty whatever about keeping a supply of it at the few ports where the early motorships bunkered. The oil was plentiful enough for the demand, and the approximate dates for the bunkering of vessels was pretty well known.

Since 1920 there has been such a great increase in the number of motorships and they have been adopted by so many shipping companies that they are today operating all over the world. They may need to bunker in any port. The distribution of fuel oil has kept pace with the demand, and there are big chains of oil bunkering stations circling the globe. At numerous ports Diesel oil is kept regularly in storage. At other ports only boiler fuel is obtainable.

The supply of the so-called Diesel oil is slowly but surely being reduced through influences that the oil companies cannot control. The enormous increase in the number of automobiles requires oil companies in every country and under every flag to produce ever-increasing quantities of gasoline. The natural supply of gasoline is not nearly adequate to the demand, and necessity has fostered the development of what are termed cracking processes, whereby gasoline can be obtained from the heavier grades of oil, ranging up to and including all grades that formerly yielded gas oil or Diesel oil. It follows that the distribution of this good grade of oil engine fuel is being curtailed. In the course of the next decade it will possibly disappear entirely from the market.

MOTORSHIP has frequently drawn attention to these changes in the oil world and has urged the desirability of arranging engines to burn the lower grades of fuel. Today there are many ships on which this is being successfully accomplished. Since it has been demonstrated that engines can burn low-grade oil and since they have from the very start of their development been able to burn good oil, it is evident that there is no complication in providing for their adaptability to the consumption of any grade of fuel. In different engines different changes will be necessary, but for the most part these alterations will be confined to the atomizers and to the fuel nozzles if the installation has already been arranged for the consumption of lower grades.

The ideal plan would be to have a chart of fuel oil gravities and viscosities with a notation of the fuel injection arrangements best suited to the different grades. This would give direct instructions to the chief engineer as soon as he was advised of the characteristics of the oil taken aboard.

In the case of engines equipped only for burning Diesel oil the initial changes would necessarily have to be more extensive because of the provision of means for making the viscous fuels sufficiently fluid to get them to the fuel injection valve.

In reflecting on this subject it must be remembered that oil supply and distribution throughout the world are matters not controlled by any single oil company or by any group of companies, but are ruled by geological conditions as well as by industrial influences. A region that yields a large quantity of oil one year may be almost dry the next year. New fields are constantly being opened up and others are being exhausted. These changes are responsible for big differences in the qualities of crude, and these in turn affect the character of fuel oils that are marketed. There is no industry in which the grade of raw material flucuates so widely as it does in the oil business. The manufactured products, which are, of course, the gasoline, kerosene, heavy distillates, gas oil, lubricants, etc., are kept within reasonable standards, but the residues, which are the lower grades of fuel, cannot be regulated. If customers insist upon specific standards of fuel oils they can get them, but the oil companies would have to charge for that service and the price would not accord with consumers' ideas of fuel prices.

The ship that has engines capable of burning any kind of fuel will be the one best served all the time. It will get the best prices, it will not be subject to delays, and the engineers will have no fuel troubles. These advantages will become more and more marked with each passing year, and though today the matter may not seem to have any pressing importance, it is, nevertheless, one which operators and Diesel engine manufacturers should seriously study because it is already important enough to give them advantages.

Dolius and Sycamore

Those who have read the reports of the trials of these two motorships, which we reviewed in the May issue of this magazine, will appreciate the following letter published in the *Engineer*, London:—

Sir—There should be no difficulty, for one versed in the fundamental laws of physics, in explaining the apparent discrepancies in the test of the SYCAMORE and the DOLIUS. It is only one more example of the conservation of energy.

Some years ago I was concerned with the operation of an electricity works at Portsmouth, N. H. At one time we appeared to be losing a large quantity of power in some unexplainable manner. The quantity of current distributed from the works and used by the auxiliaries was very much less than that generated by the prime movers. Each of the watt-hour meters came to rest when its circuit was opened, showing that at one point at least, and that a very important one, its calibration curve was correct. This condition continued for several weeks. An explanation was sought in vain. Suddenly, although no change had been made in meters or wiring, the discrepancy reversed itself. More power was used or distributed than was generated. This condition continued for several weeks also, but eventually normal conditions were restored, and the metered current generated balanced with that used or distributed. A careful computation was then made of the number of kilowatt-hours gained during the later period. It was found that the two quantities were exactly equal.

Now, if you will calculate the exact number of foot-pounds or horsepower hours which disappeared from the shaft of the SYCAMORE, you will find that precisely the same number of foot-pounds or horsepower hours reappeared in the shaft of the DOLIUS. WILLIAM F. RYAN.

Syracuse, N. Y.

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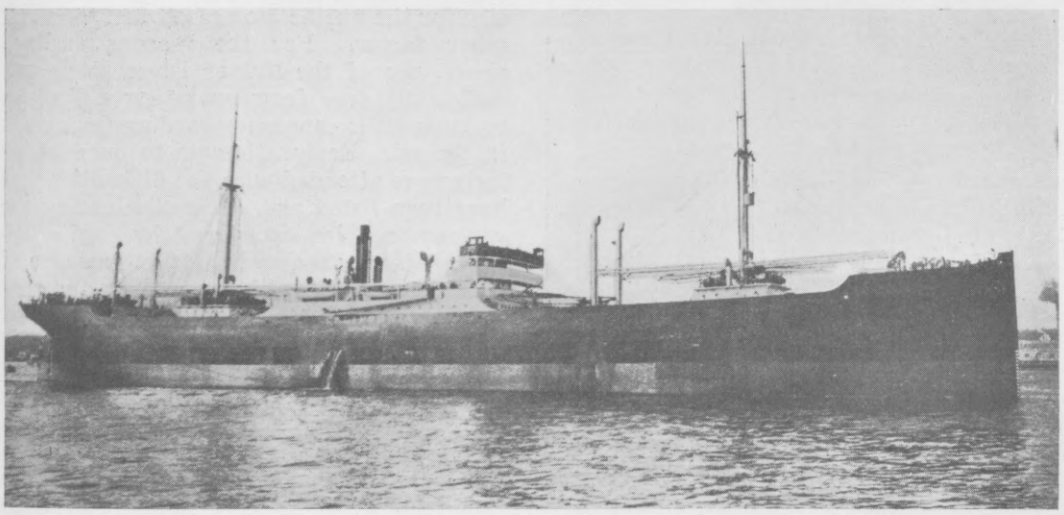
Centrifuging Fuel on 12 Years Old Motorship

Chief Engineer of M. S. California Relates Improvement in Operation Since Fuel Has Been Mechanically Treated

ONE of the first half-dozen motorships built by Burmeister & Wain recently made another of her rare visits to an American port. She was completed in 1913 for Det Forenede Dampskibselskabet, sometimes known as the United S.S. Co. of Copenhagen, and has had 12 years' successful operation with her original machinery.

When the CALIFORNIA was ordered, immediately subsequent to the first successful demonstration of the SELANDIA owned by another Danish Company, the benefits of electrical deck machinery were very widely doubted. Det Forenede D/S S. was numbered among those who considered that the choice of Diesel power for the main machinery was sufficient of an experiment



Danish motorship California which is now 12 years old.

in itself, and they preferred to retain the steam operation of steering engine, windlass and winches. With this single exception they followed the Burmeister & Wain practice of those days.

Her main engines consist of two 8-cylinder sets developing together about 1850 s. hp. They are very slightly larger than those of the SELANDIA, but of the same design. During the 12 years of her operation she has covered about 400,000 miles, nearly all on the run between Copenhagen and the River Plate. At sea the engines average above 700 revolutions per mile; therefore, since they first turned over they have made nearly 325,000,000 revolutions. In all that time there have been no piston losses through any cause whatever. The engines are operating today with the original pistons built into them in 1912. One of the engines has had a new half section of crankshaft—the replacement having been made because of signs of weakness developing in the after throw, but without any actual fracture having occurred.

How many cylinder heads have been changed during the 12 years is not known aboard the ship, but during the past five years—since the machinery has been under the care of Chief Engineer Wilhelmsen—there have been five cylinder-head replacements. In each of these heads a crack developed between the fuel valve and the exhaust valve. This is always the most highly stressed part of the cylinder head, and probably in course of time the water passage between the exhaust valve chamber and the fuel valve chamber becomes obstructed by the deposit of salts, thereby increasing the stress.

Apart from the replacements mentioned, there have been no major changes in the engines. The original auxiliary machinery is also operating with entire satisfaction. A few months ago the vessel was bunkered at Copenhagen with a 50-50 mixture of boiler oil and of solar oil. The Chief was not handed an analysis of either grade separately or of the mixture, but he states that oil from the bunkers averaged about 24 deg. Beaume. To what extent the oils actually mixed is a matter of doubt. It is important to bear this in mind when considering the experiences which the Chief has had since that date. On the passage to Buenos Aires the fuel was allowed to settle 12 hours in the day tank before use in the engine. From each settling the amount of sludge drawn off was about one-third of an ordinary pailful.

That this mixture was unsatisfactory was indicated by trouble on three of the injection valves. Ordinarily the fuel valves gave no trouble at all. They were changed periodically during the year for overhauling, and showed no defects when straight solar oil was used, which was the fuel that had been furnished to the ship ever since she first went into service. All three valves that gave trouble on the first passage after the new mixture of fuel had been filled into the bunkers were put out of business for the same cause, viz., the valve sticking fast open.

Investigation showed that sand worked up from the lower end of the fuel valve into the bushing of the fuel valve stem. The valve stuck so tight that when later examined it could not even be hammered loose. The actual cause of the trouble was discovered by sawing right through the valve chamber. The sand evidently could only have been carried over to the chamber by the fuel, and then blown upwards on account of a slight looseness of the gland.

At Buenos Aires it was discovered also that the exhaust valves had been excessively burnt. Those were the chief manifestations of trouble with the mixture of boiler oil and solar oil. Whether excessive wear developed on the pistons and liners was not ascertained.

After the ship returned to Copenhagen a Titan centrifuge was installed and piped up with the fuel-oil system. The quantity of sludge it takes out from the fuel-oil mixture is almost unbelievable. The Chief Engineer states that he gets about 650 lb. of sludge from the daily supply of fuel oil, which is about 9 tons. Part of this is water, part is sand and the remainder is an asphaltic mess. Since the engine fuel has been treated the engines have again been operating without any trouble whatever. There is no sign of foreign matter getting into the fuel-valve chambers, and the exhaust valves looked normal after the next long passage. It is possible, of course, that a relatively large amount of solar oil separated out from the mixture during the first voyage on which this grade of fuel was used and remained in the fuel oil tanks to increase the proportion of sludge. On the other hand, since the supply is still drawn in the same way from the fuel-oil tanks, it would seem that the same relative mixture now reaches the centrifuge as was pumped into the settling tanks on the previous voyage. In any event the experience here cited shows how great is the benefit of centrifuging any fuel supply that contains a heavy grade oil.

Whether the CALIFORNIA in future bunkers with solar oil or with the heaviest oil that she can pump through her fuel system will be immaterial to her from now onward, so far as dirt is concerned.

Before long the biggest motorship in the world, the SVEALAND, owned by the Brostrom interests, should be visiting an American port. This is one of the big ore carriers built by the Deutsche Werft and briefly described in MOTORSHIP of last March. She is to carry ore from Chile to this country for the Bethlehem Steel Co. and can load 20,000 tons. There are many interesting features about her, one of the most novel of which is the method of closing the hatches. Strong hatch plates are used, fitting into rubber joints and held in place by iron bolts. Each cover weighs eight tons and as there are 18 of them this means a total weight of 144 tons in the hatch covers alone. Since the vessel will have to make the outward passage to Chile always in ballast, and as the coast of that country is not regarded as very hospitable for big vessels, special provision has been made for quick ballasting, the pumps having a capacity of 2,200 tons per hour. The two main engines develop together about 4,500 s.hp.

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Centrifugal Treatment of Diesel Fuel Oils

Method Avoids Difficulties Due to Impurities, Widens Range of Suitable Fuels and Improves Engine Operation

By Lee Hinchman Clark*

THERE are distinct advantages to the oil engine user in being able to burn the heavier, so-called boiler fuel oils without difficulty in oil engines, instead of being confined to the use of the lighter Diesel fuels. The heavy fuels are sold at a lower price and, by volume, on which basis they are purchased, have a slightly greater heat value. The lighter oils are not always readily available on the market. Thus it is desirable that an engine be able to burn whatever fuel oil may be procured under all sorts of market conditions.

The publication in July, 1924, of replies to a communication addressed by MOTORSHIP to representatives of the oil engine industry, users of oil engines, and oil companies, indicated a marked preference for fuel ranging from 24 deg. to 36 deg. Beaumé for oil engine consumption. In only a few instances was a lower limit of 20 deg. Beaumé considered satisfactory. A few manufacturers expressed the belief that their engines will operate effectively on any burnable fuel.

Considering that the heavier oils may be purchased more cheaply and are often in better supply than the lighter Diesel fuels, it is interesting to inquire into the reason for the almost universal desire for oils between 42 deg. and 36 deg. Beaumé for Diesel fuel.

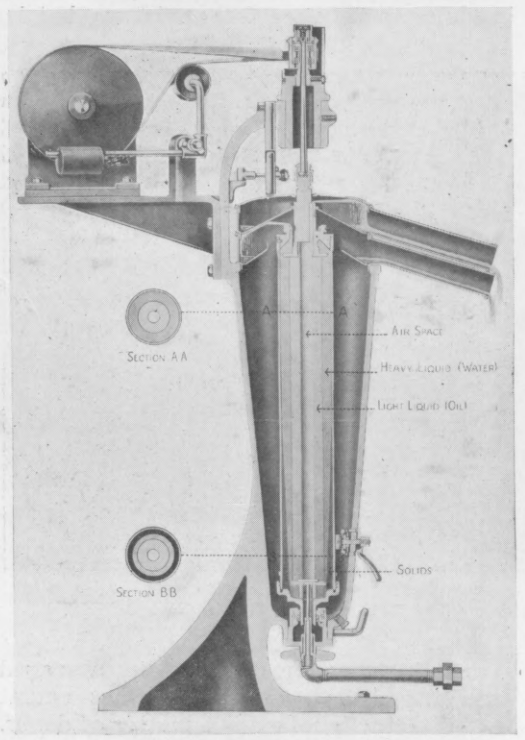
In the past certain well founded objections have been advanced to the use of the heavier fuels in Diesel engines. The difficulties that may be encountered are as follows:

(1) Difficulties in handling oils that are viscous at normal temperatures.
(2) Ignition difficulties.
(3) Difficulties in burning oil after ignition.
(4) Difficulties caused by the presence of small quantities of impurities in the oil.

The drawbacks listed under the first three headings can and are being overcome by the proper design of engines and of their fuel storage and handling systems, and by an understanding of the proper variations necessary in operation to change engines from the use of the lighter to the heavier fuels. It is not possible to overcome the difficulties due to impurities in the oil burned in the same manner. Their removal constitutes an entirely separate problem. Failure to appreciate the distinction has been responsible for attributing many troubles caused by poor operation and design to foreign matter present in the heavier oils.

There is ample evidence that many engine manufacturers have solved the problem of producing Diesels that are mechanically capable of burning the heavier oils without difficulty. The majority of the larger engines now being put in service are adapted to burn the heaviest fuels, if such fuels are sufficiently free from impurities. The same is not true of some types of engines, particularly those of older design, and it is illogical to expect an engine not designed for them to operate effectively upon the heavier oils, even though such oils are well purified before use.

The preference that has been noted for the lighter fuels may be explained on the basis of their relative freedom from handling difficulties and from excessive trouble due to impurities. The high Beaumé gravity oils are normally of low viscosity. They are sufficiently mobile for pumping, at normal temperatures. Compared with the low Beaumé gravity fuels, they are not as apt to hold mechanical impurities in suspension, first, because of their lower viscosity; secondly, because — there are greater differences in the specific gravities of the oils and those of the impurities. As a result of these conditions a large part of any water and solid impurities settle by gravity while the lighter oils are in storage tanks. Various types of filters have been used to remove impurities that do not settle by gravity.



Section through fuel centrifuge

Centrifuging Is Positive

Centrifugal treatment is, however, more efficient than either gravity sedimentation or filtration, as can be shown by the impurities removed centrifugally from oil even after the two former methods of purification have been used. Even where it is necessary to heat the lighter oils to obtain a more ready purification, moderate temperatures are sufficient.

Experience has proved that oil between the limits of 24 deg. to 36 deg. Beaumé will burn well in most engines without giving rise to undue maintenance charges. It should not be assumed from this, however, that an efficient purification device cannot be used to advantage to still further improve combustion and eliminate engine wear. The centrifugal is the most efficient apparatus for this service since it removes impurities more completely than either the filter or gravity settling tanks, and its operation is not complicated by filter media and does not result in accumulations of sludge or emulsions that result in oil loss, that are difficult to handle and of which it is troublesome to dispose.

The desire to use oil of any gravity in Diesel engines has probably done more to impress the oil engine user with the necessity for the purification of all fuel than any other factor. For the reasons outlined above, use of the lighter Diesel fuels was sufficiently free from operating difficulties to cause little concern regarding impurities in the oil. Early attempts to burn boiler fuels were attended with the difficulties that have been listed and, after eliminating the various troubles occasioned by engine design, it is now realized that the presence of impurities in the oil is responsible for poor operation and excessive wear in the engine.

In the past few years a great number of oil engine power plants have been equipped with centrifugals for the purification of fuel before burning. No difficulty has been found in effecting very complete elimination of harmful suspended impurities at high capacities when working upon fuels about 18 deg. Beaumé and above. In handling the majority of fuels below this gravity, the fuel is much improved, but it has been felt that the centrifugals were not as effective as they are with lighter fuels.

Heating Oil to Be Centrifuged

In order to obtain an entirely satisfactory purification of oils, except those that are very light, it is necessary to heat the oils before centrifuging. The temperature employed for centrifugal operation depends on the viscosity of the oil and the extent to which this viscosity must be reduced before satisfactory results can be obtained by centrifugal treatment. To centrifuge an oil with a gravity in the neighborhood of 30 deg. Beaumé, a temperature of approximately 120 deg. Fahr. is usually sufficient. To handle the majority of oils having a gravity below 20 deg. Beaumé, it is highly desirable that temperatures ranging up to 210 deg. Fahr. be obtained. A temperature of about 150 deg. Fahr. is often very close to, if not above, the flash point of many of these oils, and, with the ordinary centrifugal, one of the chief difficulties previously encountered has been the danger from escaping fumes that are developed when heavy oils are heated sufficiently for satisfactory centrifugal treatment. This is, of course, a serious disadvantage in a power plant.

As a result, the maximum efficiency has not been obtained in using the open type centrifugal on heavy fuels, since it has been

*Chief Chemist, The Sharples Specialty Company.

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compulsory to operate with oil at temperatures below that necessary for the best results.

To overcome the temperature limitations imposed upon treatment of fuel oil with the open machine, the Sharples Specialty Company has developed a centrifuge in which the centrifugal operation is carried out in a totally inclosed frame or housing within which the centrifugal bowl rotates. This frame is built to withstand any pressure that may be developed by gases from hot oil. No gases may leak from the machine to constitute a fire hazard, with the result that it is possible to centrifuge heavy oils at the temperature necessary to procure a satisfactory reduction in the solid and water content. Oil may be centrifuged at a temperature up to and above 200 deg. Fahr., often well above the flash point of the heavier fuel oils, if that is required to secure satisfactory results.

To illustrate the advantage in heating the heavy fuels, an example of tests run on a 16 deg. Beaumé Bunker C oil with a flash of 150 deg. Fahr., is interesting. At 140 deg. Fahr. the oil had a viscosity of 16.3 deg. Engler. Heated to 170 deg. Fahr., the viscosity was reduced to 8.0 deg. Engler. Elevating the temperature by 30 deg. Fahr. above that at which the oil could be handled in the open centrifugal reduced the viscosity of the oil by one-half, making it possible to double the efficiency of the centrifuging operation.

Prevention Better Than Cure

Those impurities in fuel oils that have been blamed to the greatest extent for poor engine operation when the heavy oils are burned are water, non-combustible material and sulphur. Water, if present to any appreciable extent, is usually found in pockets in the oil, and consequently causes misfiring and erratic working of the engine. Finely divided water to the extent of several per cent, distributed homogeneously through the oil, will cause no difficulty. The governor will automatically admit to the cylinders a slightly greater charge of such oil than of perfectly dry oil. Each stroke will be a repetition of the last. The engine will run smoothly and burn the oil cleanly. Water in pockets results in great variations in combustion conditions. The engine may be running smoothly on practically dry oil when the fuel pump suddenly draws a mixture that may consist principally of water. The result will be a feeble stroke, or even a complete misfire. Even with a certain amount of oil present in the charge, a misfire may result. The unburned oil then mixes with the lubricating oil on the cylinder walls and so contaminates the lubricant. When large amounts of water enter the cylinders with the oil, the engine loses speed, so that on the next stroke the governor admits an increased charge, and until operation is again regular the engine runs under overload conditions.

This irregular firing is responsible for the formation of carbon in the cylinders, and in extreme cases may cause seizure of the piston. Irregular firing may be detected by watching the exhaust, which will smoke intermittingly when burning fuel oils containing water that is irregularly dispersed in the oil.

The non-combustible material in fuel oil is, in part, abrasive in nature, and as such may cause very serious wear on cylinder liners and pistons. The most common impurities are sand and rust from pipes and storage tanks. The amount of these impurities that is introduced into the cylinders per stroke is very small, but it amounts to a great deal in the course of a few months' running. When the oil is burned, the coarser of these impurities are deposited in the cylinders and form an abrasive paste with the lubricating oil. Examination of this material, when collected from the oil by centrifuging, leaves no doubt as to its abrasive qualities and the part that it plays in increasing operating cost and diminishing the reliability of an engine.

The presence of water and suspended solids is not confined to any particular type of oil. Distilled oils are free from these immediately after production, but the impurities are rapidly introduced in handling and in storage.

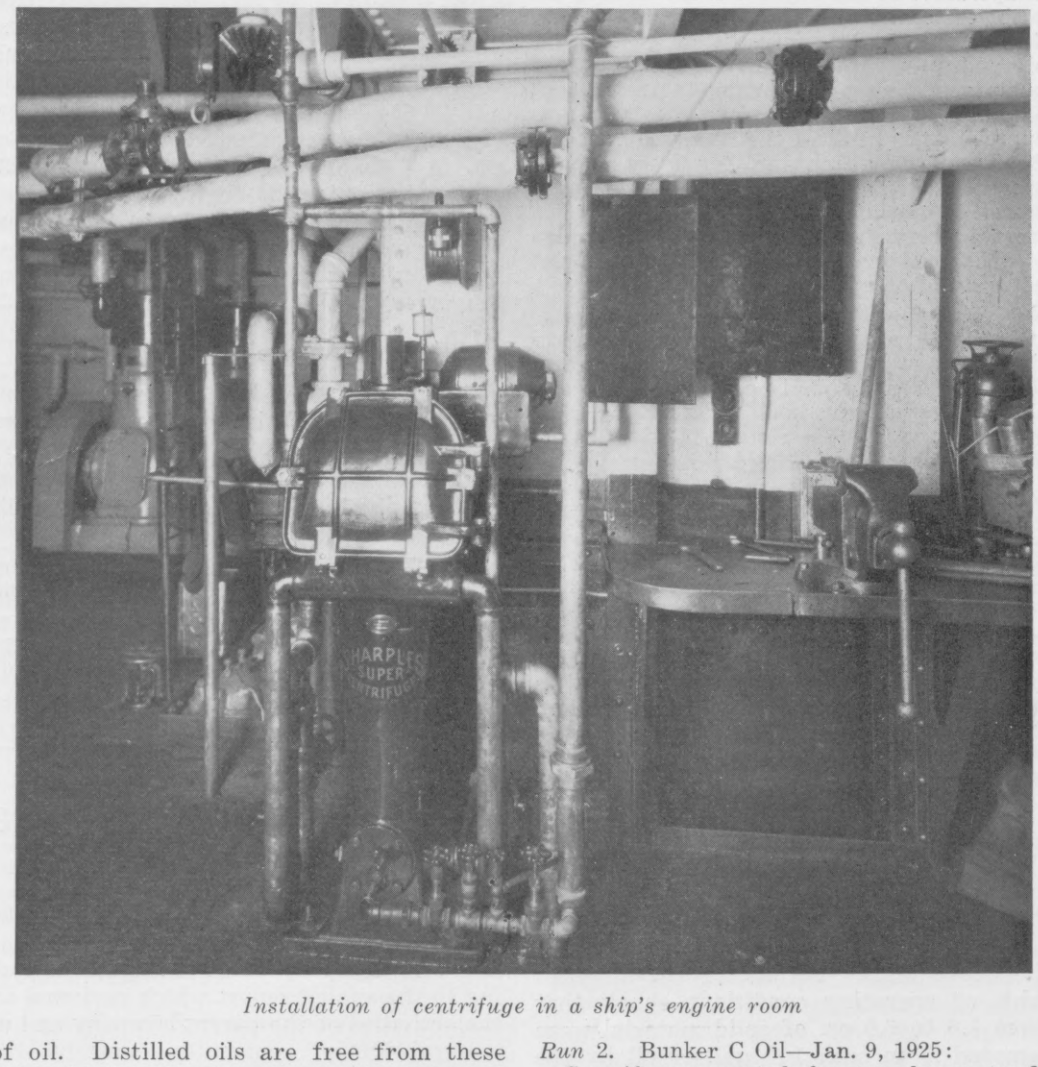
Sulphur is found principally in the lower Beaumé gravity oils. The objections often mentioned to the use of high sulphur oils undoubtedly arise from the fact that these oils are the viscous fuels which do not free themselves readily of suspended impurities. Sulphur burns to sulphur dioxide, which is unquestionably non-corrosive under the conditions existing in the engine while running. It is only when the engine is stopped without first flushing the burnt gases from the system that the sulphur dioxide may combine with the condensed water and become corrosive. The use of lighter oils of low sulphur content before stopping is often practised to remove the heavier oils from pump and fuel lines where it might solidify and cause trouble in restarting. Such a use of light fuel is doubly desirable since, if it is practised, it removes the potentially corrosive sulphur gases.

Oil Engine and Centrifuge Tests

Through the courtesy of O. E. Jorgensen, chief engineer of the Worthington Pump & Machinery Co., arrangements were made to install one of the Sharples centrifuges on the double-acting two-cycle engine at the Snow Holly Works. This is a single-cylinder test engine rated to develop 750 b.hp. at 90 r.p.m. and consuming around 40 gal. fuel per hour.

The following notes refer only to the outstanding incidents of each of the runs for which figures are tabulated herewith.

Run 1. Bunker C Oil—Jan. 8, 1925:
Standpipe replaced by 150-gal. tank.



Installation of centrifuge in a ship's engine room

Run 2. Bunker C Oil—Jan. 9, 1925:
Centrifuge operated for two hours to fill tank. Engine not run.

Run 3. Bunker C Oil—Jan. 12, 1925:
This day's operation was carried on with no trouble of any kind, the engine developing full power, clean exhaust and no misfiring. No water was discharged from the Bunker C oil but the Sharples centrifuge removed 4.6 ounces of sand and dirt per hundred gallons of fuel, at an operating temperature of 180 deg. Fahr.

Run 4. Bunker C Oil—Jan. 13, 1925:
The temperature of the oil before centrifuging was raised to 200 deg. Fahr. and solids removed increased to 5 ounces per hundred gallons, although the increase consisted of the more gummy finely divided carbonaceous material rather than an increased quantity of sand.

The run was extended until fuel and engine run tanks were emptied to lowest gage to make ready for a change of fuel on the following day.

Runs 5 *and* 6. Panuco Crude—Jan. 14 and 15, 1925:

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Centrifuge and Oil Engine Test

CENTRIFUGE OPERATION						IMPURITIES REMOVED FROM OIL				ENGINE OPERATION			OIL CHARACTERISTICS	
						Water		Dirt						
Date 1925	Run No.	Hours Run	Oil Cleaned Gal.	Oil Cleaned Gal./Hr.	Avge. Temp., Deg. F.	Total Gal.	Per 100 Gal. Oil	Total Oz.	Per 100 Gal. Oil	Hours Run	Oil Burned Gal.	Oil Burned Gal./Hr.	Name	Gravity at 60 deg. F.
1/8	1	1:30	76.6	51	158	None	...	....	...	1:40	75	45	Bunker C	16.0 deg. Bé.
1/9	2	2:00	118.0	59	159	None	...	8.0	4.1	....	...	..	Bunker C	16.0 deg. Bé.
1/12	3	5:40	263.4	46.5	181	None	...	12.0	4.6	5:40	241	43	Bunker C	16.0 deg. Bé.
1/13	4	6:45	278.3	44.5	199	None	...	14.0	5.0	8:50	412	47	Bunker C	16.0 deg. Bé.
1/14	5	2:45	142.0	51.6	183	Trace	...	4.0	2.8	1:30	57	38	Panuco Crude	11.8 deg. Bé.
1/15	6	5:00	308.1	61.6	168	3.5	1.2	7.0	2.2	6:00	283	47	Panuco Crude	11.8 deg. Bé.
1/16	7	2:20	94.5	43.0	165	2.5	2.6	1.5	1.6	4:30	236	52	Panuco Crude	11.8 deg. Bé.
1/17	8	2:15	99.4	44.2	194	None	...	5.0	5.0	....	...	..	Heavy Fuel	19.0 deg. Bé.
1/19	9	4:40	273.0	58.5	202	None	...	17.0	6.0	7:10	373	53	Heavy Fuel	19.0 deg. Bé.

The centrifuge was adjusted to meet the change from 16 deg. Bé. to 11.8 deg. Bé. oil. It was found necessary to go no higher than a temperature of 170 deg. Fahr. for heating the oil before centrifuging. A temperature of 180 deg. Fahr. caused the formation of gases in the oil and prevented proper operation of the pump supplying the centrifuge. The amount of solid impurities removed from this oil was approximately one-half that removed from the Bunker C oil. However, water was found present in this oil, evidently in pockets judging from the irregular manner in which it came from the centrifuge. Operation of the engine on the centrifuged fuel was entirely without misfiring or otherwise erratic performance.

Run 7. Panuco Crude Oil—Jan. 1, 1925:

At the end of this run the top cylinder injection valve was removed and found in first class condition, perfectly clean, without gum, oil or scores of any kind on it. Clean combustion through entire run.

Runs 8 *and* 9. Outside Storage Heavy Oil—Jan. 17 and 19, 1925:

Centrifuge run only to fill engine run tank. This oil is very heavy viscosity cold but has a higher gravity, about 19 deg. Bé., and the oil is very thin at centrifuging temperature 190-200 deg. Fahr. This oil contained no water but very much more dirt than either the Bunker C or Panuco crude oil run in these tests. On the 19th considerable difficulty was experienced upon starting, as the pump and all lines were filled with the viscous oil. After warming the system, no further trouble was encountered.

Conclusions from the Tests

The need of an effective method for cleaning Diesel fuel oils is clearly indicated in the amount of impurities that were removed from the various oils in the course of the above tests. Perusal of the attached table of operating conditions shows that from 1.6 to 6.0 oz. of solid material were removed from each 100 gal. of oil by the centrifuge. The variation is due to the different characters of the oils centrifuged. In any one oil the amount removed runs fairly constant.

Analyses of samples of the dirt secured in this way showed that the dirt is composed roughly of 50 per cent oil, 30 per cent non-combustible material and 20 per cent asphaltic material. The most striking exhibit was obtained by washing a portion of the bowl solids in gasoline to remove oil. A gray residue remained that was very gritty to the touch and in which coarse grains of sand and tank scale were apparent to the eye. Under the microscope, low power magnification clearly revealed sharp-cornered irregular crystalline sand, dirt and scale and carbon particles.

If a commercial engine of this type is made up of four cylinders similar to the one on which tests were run, it will consume in the neighborhood of 175-200 gal. of fuel per hour instead of the 45-50 gal. burned per hour by the one cylinder engine in this test. With the 175-200 gal. of oil will go from 3 to 12 oz. of dirt that the centrifuge will remove. If not removed, approximately 1 to 4 oz. of non-combustible coarse sand, dirt and scale will be introduced into the engine cylinders per hour.

In continuous operation this amounts to 1.5 to 6 lb. of abrasive materials per 24 hours that enter the engine and contribute to liner and piston wear. The Super Centrifuge removes this dirt and to that extent contributes to better operation and longer engine life.

A Sample Installation

For an oil engine plant consuming around 200 g.p.m. of fuel the following equipment is recommended:

(1) Bunker fuel storage with sufficient heat supply to allow the oil to be readily pumped.

(2) Duplicate strainers to remove very coarse material with two-way valves for cutting in and out of service to permit of continuous service while cleaning the idle strainer.

(3) Oil pump to draw from bunker storage through strainer. This may have a slow speed rotary electric drive or it can be a duplex pump (if auxiliaries are steam driven) with a capacity of 10 g.p.m.

(4) Oil heater capacity to increase temperature from the minimum expected to 200 deg. Fahr., rated at 2000-2500 lb. per hour over that temperature rise.

(5) A relief valve set at 15 lb. per sq. in. on discharge of pump releasing excess oil back to oil bunker.

(6) Sharples No. 6 centrifuge or equal.

(7) Two-run tanks with capacities of about 1250 gal. each to receive centrifuged oil alternately and to be used for engine run tanks.

To provide for continuous service standby we recommend one Sharples lubricating oil separator or equal to be used on the lubricating oil system.

Sufficient by-passes in the piping to be installed so that in emergency either machine can be cut over on the other oil service. As the total amount of lubricating oil can be handled in very much less time than the fuel, in emergency operation the lubricating oil centrifuge can be used to give standby service for the fuel installation if so desired.

—Financial Reports—

Wm. Cramp & Sons, S. & E. B. Co.

A substantial profit was shown for 1924 by the Wm. Cramp & Sons Ship & Engine Building Company of Philadelphia according to the annual report which reviewed all the activities of the parent company and of its subsidiary companies, namely the Federal Steel Foundry Company, the De La Vergne Machine Company and the Pelton Water Wheel Company.

It was stated that the motorship SEEKONK, operated for the Cramp Company by the United American Lines, has proved highly economical and satisfactory. The number of inquiries for the conversion of steam driven vessels into motorvessels was reported to be increasing.

During 1924 the scout cruisers TRENTON and MARBLEHEAD were delivered to the U. S. Navy and the maximum premium for economy was earned on both ships.

The De La Vergne Machine Company, which specializes in oil engines and refrigerating machinery, was fairly busy during the year. The bookings for De La Vergne products increased rapidly during the latter months of 1924 and the prospects for working capacity during the year 1925 are considered to be good.

Bethlehem Steel Corporation

At the regular quarterly meeting of the Board of Directors of the Bethelehem Steel Corp. about a month ago it was stated that the operations throughout the quarter averaged 77.5 per cent of capacity, as compared with 70 per cent the previous quarter. The value of orders on hand March 31, 1925, amounted to $65,921,289 compared with $77,049,619 as of December 31, 1924, and $49,846,308 on March 31, 1924. The earnings, after all charges and preferred dividends, were stated to have amounted to $1.66 per share on the common stock or at the annual rate of $6.64. Earnings for the previous quarter were $1.08 per share.

Burmeister & Wain

Profits of the Burmeister & Wain Engineering & Shipbuilding firm of Copenhagen, Denmark, amounted to $602,378 during 1924. Of the total sum available, including the amount carried over from the previous year, the directors placed $203,157 in the reserve and renewal fund and paid a dividend of 12 per cent to the stockholders. A sum of $55,372 was carried forward into the new year. (Rate of exchange taken as 18.8 cents per krone.)

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Notes and News of the Month from Everywhere

Record of New Construction, Launchings, Trials, Ships' Performances and Other Events at Home and Abroad

Owing to requirements of the Interstate Commerce Commission the New York Central R.R. will have to call for new bids on the motortug and motorlighter on which it has already received prices from shipyards and engine builders.

Two motorships similar in nearly all respects to their STEELMOTOR and STEELVENDOR have been ordered by the U. S. Steel Products Co. for service on the Great Lakes. These boats are 250 ft. long by 42 ft. 9 in. breadth and 20 ft. moulded depth, and engines of 750 s.hp. in each ship will be measure about 1,700 tons gross. The main built by the Federal Shipbuilding Co. of Kearny, N. J., which will also build the hulls and complete the ships.

The keel of the largest passenger steamer ever contracted for in the United States was laid at the Cramp Shipyard in Philadelphia early last month. The vessel is the MALALO building for the American Hawaiian Steamship Company for subsequent sale to the Matson Navigation Company to be operated in the San Francisco-Honolulu service.

Houston Fireboat

An order has been placed with the Bethlehem S. B. Co. for the construction of a powerful fireboat for Houston, Tex. The hull will measure 117 ft. 6 in. on the waterline, 27 ft. beam and 14 ft. depth, with a draft of 8 ft. 6 in. The main engines will be two 500 hp. Wintons direct connected to Westinghouse generators which furnish electric current for the propulsion of the boat. At a fire, when the two big pumps are operating, the power for propulsion is furnished by a 200 hp. Winton-Westinghouse generator, the current from the main generators being required for the fire pumps which have a capacity of 35,000 g.p.m. at a pressure of 150 lb. per sq. in. Cox & Stevens designed the boat and will superintend its construction.

Early last month the keel was laid at the New York Shipbuilding Corp.'s yard at Camden, N. J., of the big motor tanker the firm is building for its own account.

Thrust bearings on the 14 Shipping Board vessels that are being converted to Diesel power will be of the Kingsbury type. The total value of the contract for the fourteen main thrusts is $39,200.

Each of the Shipping Board vessels which are being converted from steam to oil engine power will have 11 electrically driven winches and electrical steering gear. Bids on the equipment for this purpose will be taken by the Bureau of Maintenance & Repair during the next month. At the same time bids will be taken on the starting air tanks and pumps. Each ship will have two starting air tanks and 12 pumps.

Forty-two generators have been ordered by the Department of Maintenance & Repair, U.S.S.B. Fleet Corporation, from the Ridgeway Dynamo & Engine Co. of Ridgeway, Pa., at a total price of $60,046. Thirty-seven of these machines will be of 75 kw. capacity at 265 r.p.m. and the remainder will have the same capacity at 250 r.p.m. All these generators are for use on the 14 vessels which the Shipping Board is converting to Diesel propulsion.

On the Ford Motor Company's vessel EAST INDIAN, which is being converted to Diesel power by the Sun Shipbuilding Co. the auxiliary engine room sets will consist of two 225 hp. Worthington engines of the two-cycle airless injection type, direct-connected to electric generators. A part of the power derived from these engines can be used to run Worthington high-pressure three-stage air compressors which will deliver air at 600 lb. per sq. in. for maneuvering the ship. The compressors are of the Feather Valve type.

U. S. Coast Guard vessel AB20 with first Winton Diesel 100 hp. engine.

VANADIS has been purchased by Harrison Williams, one of the patrons of the Beebe oceanographic expedition to the Sargasso Sea and the Galapagos Islands. This fine motoryacht of 1,245 tons was built last year in Germany for C. K. G. Billings and is driven by two 900 hp. Krupp engines which give her a speed of about 14 knots.

DONNA LANE, a wooden ship of 2,185 tons gross built of wood at Houghton, Wash., in 1920 was sold recently by the Scandinavian Bank of Seattle to the Utopian Fisheries Company of the same port, for the sum of $39,000. She is a twin-screw vessel with two 6-cylinder McIntosh & Seymour engines of 500 hp. each. The vessel will enter the Alaskan fishing trade.

RABY CASTLE, the new single-screw motorship propelled by an 8-cylinder Werkspoor engine of 2,250 s.hp., was in Charleston, S. C., recently on her maiden voyage and loaded a cargo of cotton, linters, sweepings, logs and lumber for continental North Sea ports. The vessel is owned by J. Chambers & Co. of Liverpool.

The former AELDGYTHA, a twin screw Diesel-engined yacht built in 1914 for F. A. Hardy of Chicago was in Florida waters this winter apparently just as good and serviceable now as she was 11 years ago. She is owned by Mrs. A. M. Hollingshead of Camden, N. J., and is now named the MARCHETA. She has been through several ownerships since Mr. Harvey sold her in 1916. The machinery consists of two Craig engines of 120 hp. each.

New Barge Canal Tug

Among the new towboats operating on the New York State Barge Canal this year is the tug ENDURANCE owned by the Oil Power Towing Corporation and chartered for the season by the Dispatch Shipping Corp. She is 64 ft. 11 in. in length, 16 ft. 4 in. beam and 10 ft. molded depth, with a 6-cylinder 150 b.hp. directly reversible Fairbanks, Morse engine. The auxiliary equipment consists of a Rix air compressor driven by a 6 hp. engine, a fire and wrecking pump, a 4-in. centrifugal pump and a 1½ in. rotary pump for the bilge and for washing down the decks. She is electrically lighted and is equipped, like all the Canal tugs, with a powerful searchlight. Built by Craig Brothers Marine Railway at Norfolk, Va., she had to run up the coast to New York. She covered the distance in 35 hours in a heavy sea, running against a northeast gale. Captain Harry Tellefsen stated that he had a good opportunity to test the ability of this type of engine for maneuvering during the time the compass was being adjusted before leaving Norfolk. This job took about two hours, during which time it was not necessary to start the auxiliary air compressor, sufficient air being always available from the eight 20 in. by 60 in. air tanks provided in the installation.

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Recommendations of Shipowners

At a combined meeting of the American Steamship Owners' Association, Pacific American Steamship Association and Shipowners' Association of the Pacific held in New York last month a lengthy statement was drawn up embodying the recommendations of these Associations for an American Merchant Marine. The meeting started from the basis that under existing differentials in fixed charges and cost of operation, upkeep and overhead as compared with those of foreign competitors, and under the more burdensome provisions of the navigation laws, private owners of American vessels must have assistance and relief. It was held that the items of higher cost in the ownership and operation of American vessels in foreign trade are due largely to the following items—

(a) Greater capital investments due to higher shipbuilding costs in the United States, with resultant larger interest charges, higher depreciations and increased insurance premiums.

(b) Larger crews and higher wages in respect of both officers and crew.

(c) More expensive food scale for officers and crew than required by foreign nations.

(d) Fifty per cent duty on repairs made in foreign ports and higher costs of repair in American ports.

(e) Unnecessarily burdensome and expensive inspection laws.

(f) Numerous pay-day demands and provisions in laws making it difficult to enforce discipline in foreign ports, and resulting in delays from dissipation and insubordination.

(g) Government fines resulting from smuggling aliens, liquors and narcotics, despite every effort by shipowners to prevent them.

(h) Greater costs of equipment and supplies.

(i) Unfair admeasurement rules, resulting in increased Panama Canal tolls and port charges based on the tonnage of American ships.

(j) Higher costs of overhead due to higher standard of wages in the United States.

In the opinion of the combined Associations these higher costs and disadvantages can be counterbalanced by the adoption of the 48 recommendations which the Associations have prepared for the government. These cover direct aid and indirect aids and relate to many different items. A copy of the report can be obtained from the American Steamship Owners' Association, 11 Broadway, New York.

Chairman O'Connor of the Shipping Board in launching his plan for a Merchant Marine Reserve remarked—"If out on the unprotected side of our tariff wall an American is going into business on the ocean he has got to have help from the U. S. Treasury. . . My plan is that when a man buys one of our ships and operates it in foreign trade, he shall be entitled to get out of the U. S. Treasury $20 per month for each man in his crew. The sailor employed however, must be an American citizen. . . If we sell all of our ships to private operators, which in the course of time we would hope to do, it would cost us less than $6,000,000. a year."

Ford Motor Co. May Convert 30 Large Steamers

In an interview with a United Press correspondent Henry Ford has been quoted as having stated that he is investigating the conditions of some of the larger vessels which the Shipping Board has for sale and may buy as many as 30 of them for his shipments to foreign countries. To put them into service, he explained he would strip them of their boilers and steam machinery and convert them into Diesel engined ships. This plan has no relation to the possible purchase by Mr. Ford of 400 Government owned ships which he would break up and use for scrap, a deal which could not be put through unless the Shipping Board is convinced that Congress recognizes a large part of the Government fleet as worthless and better junked than kept.

American Ocean-going Vessels

In overseas foreign trade, as distinguished from nearby foreign trade with countries in the Caribbean region and Canada, there were employed on April 1 a total of 433 ships, made up as follow:

	SHIPS	PASS. FREIGHTERS	TANKERS
Private owned	17	55	46
Government owned ...	20	291	4

In the nearby foreign service a total of 198 vessels were employed, of which 40 were passenger carriers, 69 were freighters and 89 were tankers—only eight of these were government owned.

In the domestic coastwise service there were 663 vessels, of which only seven tankers were government owned. The composition of this group was 103 passenger vessels, 376 freight carriers and 185 tankers.

In announcing a national conference, representative of all agricultural, commercial and industrial interests directly concerned in shipping, the Chamber of Commerce of the United States states that four broad aspects of the question will be considered: 1. the relation of the Merchant Marine to American foreign trade and the National Defense, 2. government administration and regulatory relations to the shipping industry, 3. government aid to shipping, and 4. the disposal of the government owned merchant ships.

Senator W. L. Jones, Chairman of the Senate Committee on Commerce, returned the middle of last month from his travels in South America. Speaking at the Maritime Exchange in New York soon after his return, Senator Jones said he was convinced that the United States should maintain the present steamship service to South America at whatever cost necessary. The great developments of the future, so far as the foreign commerce of this country is concerned, will come from South America and the Orient, he continued. In his opinion shipowners and ship operators will have no difficulty in getting favorable action in Washington if they develop a real plan for shipping.

Atlantic Shipbuilders Meet

At the eighth annual meeting of the Atlantic Coast Shipbuilders Association in Philadelphia last month the officers for the ensuing year were elected, and definite steps were taken to set up a constructive plan of action intended to conserve American shipyards as a force in the development of the American Merchant Marine. The new officers are:—President, J. Harry Mull, president of Cramps; Vice-President, Ernest Lee Jahncke, president of the Jahncke Dry Docks, Inc.; Treasurer, W. G. Groesbeck, vice-president of the New York Shipbuilding Corp.; Secretary, Clarence Samuel King, who has been identified with the Association since its inception.

The Association adopted the view that any legislative proposal seeking to solve the merchant marine problem must also ensure to the country adequate shipbuilding facilities as an essential background for the successful upbuilding of American shipping. There is no more reason why American shipbuilders can compete with the shipyards of other nations without governmental assistance than our manufacturing interests can compete with the foreigner without the aid of a tariff. The secretary reported that the Association today is practically 100 per cent representative of the shipbuilding industry on the Atlantic seaboard and the Gulf of Mexico and recommended that the Association now enlarge its scope by accepting the memberships of yards along the Great Lakes and on the Pacific Coast that seek closer affiliation, but have heretofore been barred because of geographical location.

The functions of the organization are primarily directed towards permanently establishing shipbuilding on a profitable basis. The Association opposes the competition of government with private business and is fighting all legislation under the terms of which the navy yards and arsenals would supply the government requirements at an increased cost to the government without adequate return to the taxpayer.

Leigh C. Palmer, President of the Fleet Corporation, in an address before the Chamber of Commerce of the United States stated:—"If the subsidy principle should be definitely abandoned it would seem impossible to extend the principle of protection to the merchant marine in a manner and to the extent that will be necessary to place our ships on a competitive basis with their foreign rivals. It follows that this negative attitude may leave us practically committed to government operation indefinitely." That these are the only alternatives does not seem to be recognized as widely and clearly as should be the case.

Chairman O'Connor of the Shipping Board has written to the Chamber of Commerce of the U. S. requesting that their delegates be instructed to object to the discussion by the Brussels Conference of any sugestions or proposals for changes in the coastwise laws of the United States. It has been reported that the British and Japanese delegates intend to bring the matter up for discussion indirectly by proposing that nations should reciprocally agree to open their coastwise trade to vessels of nations which give the same privileges.

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Herring Carriers at Eastport

AT Eastport, Maine, 10 large canning plants are operated for nearly six months during the year. Eastport, the farthest east seaport and close to the border, is the chief center of the Maine sardine canning industry and it is there that the largest part of the pack of Maine Coast sardines is canned. Last year the coast pack amounted to 1,700,000 cases of 100 cans each, which was below the annual average. One of the principal canners is the Booth Fisheries, which in addition to the plant at Eastport has four other installations along the coast. The company owns four oil-engined craft of similar design, 64 ft. 6 in. in length with 15 ft. 9 in. beam and 5 ft. 8 in. draft. These boats, the PATROL, PATRIOT, PIONEER and BLACK DIAMOND, were built in 1918 with 60 hp. Fairbanks Morse engines at a cost of about $15,000 per boat. They are regarded as among the best of the herring carrying craft that use Eastport during the fishing season.

Last winter the PATROL was used for carrying split, salted and smoked fish between Eastport, Maine, and Gloucester, Mass., a distance of about 300 miles. Her capacity, like that of the other three boats, is 60 hogsheads.

Patriot, Patrol and Black Diamond of Booth Fisheries Co., have 60 hp. oil engines.

Among the Maine companies which have replaced gasoline engines by oil engines is the Seacoast Canning Co., also of Eastport. A picture of their three boats is given on this page. The auxiliary SYLVINA W. BEALE on the left of the illustration was built in 1899 as a sailing boat, was later equipped with a 60 hp. gas engine and in 1918 received a 60 hp. oil engine. She is a boat of 42 tons gross and can carry 100 hogsheads of herring. She measures 71 ft. 7 in. in length overall, 17 ft. 2 in. beam, and draws 7 ft. The center boat, LILLIAN, is a 60 footer with a 30 hp. oil engine. The HELEN MCCOLL still has to be converted. She has a 60 hp. gas engine.

During the fishing season there are sometimes as many as 35 oil-engined boats in Passamaquoddy Bay and Eastport Harbor.

Two auxiliaries on left, owned by Seacoast Canning Co., have oil engines

Muffling Fishing Boat Engines

Fish boat operators have been much more interested in muffling the exhaust from their engines since they have been subjected to summary gunshot orders to lay to for Coast Guard inspection. One does not need any imagination to understand what happens when the noise of the engine prevents the sound of the warning shots being heard. The Maxim Silencer Company has notified us of a very satisfactory installation they carried out on a fishing boat operated by Lemuel Firth of Gloucester, Mass. This boat has a 100 hp. engine, the exhaust pipe from which ended shortly above the deck without any muffler attached. The Maxim Silencer firm was called upon to fit a 6 in. steel muffler, which has given complete relief from the noise of the exhaust, without any reduction in the power of the engine or other evidence of back pressure. The silencer was installed on the deck of the boat and gave no trouble whatever on the score of weight and size.

Small Crosshead Engine

A two-cycle engine of crosshead type is being developed in Vancouver. It utilizes the lower end of the cylinder as a compression chamber for scavenge air, the crankcase being blanked off from the lower cylinder end. Suction and delivery of the scavenge air is through a two-way sleeve valve, with two sleeves working at different speeds in a chamber on the outside of the cylinder and the sleeves actuated by eccentrics and rockers. Mechanical fuel injection is used. The larger sizes will have sufficient compression to be cold starting with compressed air, while the small sizes will be adapted for hand starting by using a compression of about 320 lb. and an electric heating plug. The experimental engine, which is the only unit built so far, is a single cylinder 7 hp. of 5½ in. bore and 7 in. stroke, working at 500 r.p.m. The water jacket and cylinder liner are cast separately, and the cylinder cover is secured by bolts extending to the base of the engine. S. Asser, the designer, is planning to build these engines in cylinder sizes of 7 hp., 15 hp. and 25 hp. It is an engine that stands considerably higher than the ordinary small oil engine of the trunk piston type, but has compensating advantages.

A gasoline fire was responsible for the death of two men and serious injury to two others aboard the German auxiliary MAGDALENE VINNEN. Some reports have attributed the trouble to the auxiliary Diesel engine installation but this has been denied by the owners, F. A. Vinnen & Company of Hamburg.

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Thos. Orchard Lisle.....Editor
Russell Palmer .....Manager

Offices of MOTORSHIP

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Readers are invited by the Editor to submit articles, photographs or drawings relating to motorships, marine oil-engines or auxiliaries. Contributions used in the magazine are paid for on the 15th of the title month of issue, and other contributions are returned as promptly as possible.

Standardization of Engine Bidding Specifications

ENGINE buyers who have railed against the labor and time involved in the examination of the documents that engine builders submit with their bids will welcome the proposal for standardization outlined on another page of the magazine this month. There is need for a concerted and harmonious effort by all parties. Engine buyers who have yearned for simpler forms should give assistance to the sponsors of the standardization proposals. Now is the time for them to offer their recommendations and give the benefit of their constructive ideas. Engine builders who have been conscious of the confusion created by the diversity of forms in use should take the opportunity to rid the industry of this handicap. They can help by analyzing the forms now in use and segregating the essential from the non-essential, cutting away those parts which belong properly to catalogs or bulletins.

Rumblings of the dissatisfaction felt by many buyers have been noticeably increasing. This is due probably to no other cause than the fast spreading adoption of the oil engine for marine propulsion. As buyers have become more numerous there have naturally been more contacts between them, leading towards the articulate expression which Mr. Clark is now voicing. We believe that some of the engine builders have been ready for a long time to cooperate in such proposals for standardization as are now put forward and have been deterred only by consideration of the difficulties involved in attaining a unanimous pronouncement from the industry. Quite clearly the engine builders have as much to gain by simplification of the engine bidding specification as the buyers can derive from it. It will lead to a saving of time and labor and therefore of expense. It may even lead to a reduction in the amount of bidding done by engine builders because it will help to point out cases where the builder's standard sizes do not properly fit.

That the proposals will meet with the full endorsement of the entire industry and with the unanimous approval of engine buyers, is to be hoped. There is so much of good in the plan that it cannot fail to be carried through successfully, and there seems to be already sufficient promise of support behind the movement to ensure the early attainment of the desired end.

Clear Thinking Needed About Merchant Marine

IT is certain that if Congress is to be influenced favorably towards a program in aid of the development of the American Merchant Marine under private ownership a much more convincing case must be made out than has yet been presented by any of the organizations which have attempted to propound the conditions. Separate endeavors are being made by different interests to find a solution of the problems before Congress meets again.

Last month three of the most important shipowners' associations in the country met in New York and continued their deliberations until they had completed their survey of the situation and of the possible cure. In our opinion the report and recommendations issued by the combined associations after that meeting show a lack of clear vision, of proper perspective and of true sense of proportions. The problems of American shipping in world trade were practically ignored. Coastwise problems were mixed up with such little consideration as was given to the foreign-going ships, and the bulk of the attention was lavished on minor ailments that should be forgotten until the big problem is solved. It must be obvious to the youngest student of the American Merchant Marine that direct aid from the government must be the preponderating factor in the attainment of success. Yet the shipowners did not define the nature or extent of the direct aid to be sought from Congress. In fact, in skirting round this point they entangled themselves in very undesirable demands for payments from the Postmaster General. The business interests of this country will not stand for interference with the carriage of foreign mails in the most efficient manner.

More space is given in the report to proposed amendments of the Seaman's Act than was devoted to the subject of direct government aid. Yet this is really a different problem. Whatever new legislation is needed to regulate the relations between seamen and masters or seamen and owners is just as essential under government operation as it is under private operation. The future of the American Merchant Marine is not dependent on that.

It is also unwise for shipowners to declare against the repeal of the 50 per cent duty on repairs to American ships in foreign yards. This tariff provision is tied up with a national policy that has repeatedly been endorsed by the whole country. Whatever burden it places upon American shipowners should be taken care of in a similar way to the provision that must be made to compensate for higher capital costs of construction and higher costs of operation. It is absurd for shipowners to suggest that protection be withdrawn from shipbuilding while they are asking that protection be given to them.

It is indeed difficult to find anything in the report at all constructive or helpful to the major problem of establishing the American flag firmly on the seven seas. There is ground for hope that really effective proposals will be formulated by the conference which the Chamber of Commerce of the United States has decided to organize between the varied commercial, agricultural and industrial interests for the purpose of consolidating the opinion of the country about the future of the American Merchant Marine. A much broader view will undoubtedly be taken than the shipowners themselves have displayed and the conclusions should be much more representative, because they will be influenced by the sentiment of the principal national interests as well as by the feelings of representative individual taxpayers.

Studying Qualities of Fuel Oils for Motorships

THERE still persists in the motorship world a considerable aversion to the use of any fuel other than the so-called Diesel oil. It is only natural that preference should be shown towards a fuel which introduces no problems of its own and is so well adapted to combustion in the types of oil engines now used. Progress in design and improvement in construction have advanced so far during the last 10 years that today the machinery of motorvessels does not have to be regarded any longer as replete with potential troubles. Owners and operators have become free to turn their attention to other matters of motorship operation that have as yet received little study because they were deemed of lesser importance while the machinery itself was still regarded as something of an experiment.

Fuel oils are being studied to a very considerable extent today. Owners always have given a thought to them, but very few owners were found in years gone by to make trials with them. Nowadays there is a much readier disposition to seek means for successfully using fuel oils of lower grades and thereby reducing the cost of operation. We have consistently proposed the adoption of centrifuging for the purification of all fuel oil. We really initiated this line of development, and the satisfactory results recorded by those who have tried out this system have led us to continue our efforts to promote its wider adoption. Two articles deal with the subject in this issue of the magazine. One recounts the results obtained in tests at a big engine building works and the other relates the experience of a chief engineer on his vessel. The difference in the results obtained is extraordinarily wide.

The figures obtained from the m. s. CALIFORNIA will undoubtedly be questioned by many. In comparison the amount of sludge recorded in the shop tests at the Worthington plant was insignificant. The interesting contrast between the two sets of figures shows how much room there still is for the collection of information.

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Standard Engine Bidding Specifications

A Proposal to End the Confusion of Varied Bidding Forms Used by Diesel Engine Manufacturers

By G. S. Clark*

DIESEL engine design, construction and adaption for all requirements is well past the experimental stage; in fact, it is an old machine to us now. Yet on the other hand as far as installation is concerned it is only in its infancy, the years since its creation having been spent in improvements, alterations, adaption and trials, with very little thought on the sales end.

Diesel engine designers and manufacturers have failed to take into consideration that the consumer is comparatively still in the dark when considering the relative merits of basic Diesel engine construction. He is faced with the task of wading through the specifications as now sent out by the sales department of Diesel builders, all worded differently on the same fundamentals, but basically the same.

Confronted with this situation prospective buyers are like leaves before the wind and waste valuable time reading propaganda which when finally analyzed is found to be common to all. Why can't we stabilize this condition? Why can't we take each different component of Diesel engines and fix once and for all the best practice of construction as has been proven by use?

My answer to the above questions is that it can be done and must be done, if the Diesel engine is to take its place among the well established prime movers. Oil engines will never receive the proper attention of the users until such time as the details of design and construction are put before them in such shape that they can be easily and readily understood.

Quoted horsepower is also subject to change without notice. A little manipulation on the part of the builder with his bore, stroke or mean effective pressure, and his power delivery is given a very wide spread. I have in mind one engine builder who sells a single engine to deliver power from 400 to 1200 s.hp. Of course this engine must cost the same for whatever power is desired in this range, but the buyer reading through the general line of propaganda put out by the sales department of that company would probably have to analyze about four pages of unnecessary explanation to find this out. The information could be given conveniently in a standard form like the one sketched out on this page.

Most oil engine manufacturers when furnishing bids include in their figures different auxiliaries of some sort or another. These should also be standardized or their value reduced and shown, so that comparison may readily be made when bids are competitive.

As I am on the consumer end of this question, I am naturally in favor of standardization and simplification of the subject matter, and regardless of opinions to the contrary it shall and must be done. It is a question that should have been taken up by the manufacturers themselves, but in the absence of any sort of organization of oil engine builders the burden rests on the shoulders of the buyers to initiate steps along this line.

Various corporations and governmental departments have been using for some time a specification of their own conception, but as it is drawn up to meet their own requirements it is not applicable to general needs. However, it might be well to take these specifications as a foundation and by judicial and unbiased alteration conceive a Standard Specification for Bids, which will be suitable for all. No attempt should be made to stabilize or standardize the particular attributes peculiar to the different engines. These should be brought to the attention of the buyer by the builder in a condensed addendum to the specification.

In lining up a specification for bidders the specification should have first a general description, in which the necessary power is stated with the limits of rotative speed, etc., second, the fundamental details of design and construction that are common to all and which will not limit further development and improvement, third, price quotation set up showing value of auxiliaries and guarantees of power and fuel, etc.

The general description should show the kind of installation, i. e. direct or with gear or other type of transmission. The required shaft horsepower, size of components of transmission, etc., all can be worked in with the thought uppermost in mind that the information given and to be obtained must be brought out in a simple, clear manner.

The specification details should include the base, housing or crank case, bearing metal, outboard bearings, main bearings, crank shaft, side shaft, connecting rods, pistons, wrist pins, water jackets, cylinder liners, cylinder heads, valves, camshafts and cams, scavenging pump and air injection compressors (where required), fuel pump, governors, lubrication, flywheel, spares, tests and painting.

Under another heading should be included fuel oil and lubricating oil guarantees under different load conditions with different grades of oil. The net weight must be included either under this heading or under general data.

The horsepower guaranteed should be based on actual tests with the kind and manufacture of apparatus used in making the bid. The rated and maximum horse powers should be given so that we can get

* Engineering Assistant to Manager, Marine Department, New York Central R. R.

Proposed Standard Paragraph on Engine Power

Engine shall be of an approved type, for ..... service of ..... s.hp. each.
(marine, stationary or traction)

It / They shall be suitable for driving—

1. Direct connected to ..... shaft.
(e. g. propeller, line, pump, etc.)
2. ..... kw. / kva. ..... volt D.C. / A.C. generator
3. ..... kw. / kva. ..... volt D.C. / A.C. generator
with ..... kw. ..... volt exciter on same shaft.
4. Gear with ratio of ..... to 1.

It / They shall be of the vertical / horizontal, two-cycle / four-cycle, reversible / non-reversible, air injection / airless injection, full Diesel type, with .....
cylinders of ..... in. diameter and ..... in. stroke, to operate at a normal speed of ..... revolutions per minute.

On the basis of 850 ft. per min. piston speed and 90 lb. per sq. in. mean indicated pressure, without supercharging, the engine rating is ..... hp.

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an idea of just how conservative the rating is made.

When quoting the bid price on the power offered, the quantities and cost of each item included should be set up so that a clear analysis can be made. For instance a tentative line-up could be as shown hereunder.

NO.	ITEM	COST
....	Engines	....
....	Silencers	....
....	Injection air flasks	....
....	Maneuvering air receivers	....
....	Fuel Oil Separators	....
....	Lub. Oil Separators	....
....	Fuel Oil transfer pump	....
....	Circulating water pump	....

and so on, including all such items as can be used in a complete installation.

I do not put forward this outline as a model specification. However, a start must be made along these lines and it is not a one or two man job. Those interested in the progress of oil engine power should put their shoulders to the wheel and conceive a specification capable of weaving the good points of motor construction into a fabric suitable for general use and capable of receiving all good suggestions that may, in the future, be offered in the evolution of the oil engine industry.

For the convenience of those desiring to communicate with Mr. Clark it may be stated that letters should be addressed to him care of Marine Department, New York Central Lines, 6 Beaver St., New York.

Two small motor boats are engaged in carrying passengers, mail and general cargo out of etchikan, Alaska to points on the west coast of Prince of Wales Island and to Hydar in the Portland Canal, B. C. Lester Campen, the engineer writes that they are always on schedule. The smaller boat is the CARMEN, 60 ft. long by 16 ft. beam and 7½ ft depth. She has a 4-cylinder Fairbanks Morse engine which drives her at 8¾ knots. The larger boat is called the PRINCE OF WALES and measures 64 ft. 8 in. in length, 17 ft. 6 in. in breadth and 11 ft. depth. Her engine is a 100 hp. Fairbanks Morse, giving the boat a speed of 9 knots. Both these little ships have auxiliary pumping and hoisting equipment.

Five Tugs for Pennsylvania R. R.

THE decision of the Pennsylvania Railroad Co. to build five new motor tugs is bound to have a very important influence upon the big towboat owners in all ports. Four of the new boats are to replace steam tugs that are being retired, and the fifth boat represents an addition to the floating equipment of the Company caused by expansion of business. Two of the new craft are to be drill tugs and the other three are to be float tugs capable of towing two 12-car floats and equal in towing capacity to the largest tugs owned by the P. R. R. One of the big float tugs is for Cape Charles, Va. and will be used in towing between there and Norfolk, a distance of 32 miles. The other boats are for New York. All will have Diesel-electric installations, this decision having been arrived at very largely on account of the great advantage of pilothouse control which this system renders possible. The three float tugs will be 105 ft. in length and will have each two engines of 375 b.hp. direct connected to the generators that furnish current for the 575 s.hp. electric propelling motor. In the drill tugs, which will be about 75 ft. in length, the main engines will consist of two sets of 175 b.hp. each, direct connected to generators which provide the power for the 250 s.hp. electric propelling motor. On all vessels the auxiliaries and deck equipment will be electrically operated. Contracts will be let for the building of the hulls and for the machinery, but the installations will be carried out at the Hoboken shops of the Railroad Company by the regular staff.

Big Cutter for U. S. Coast Guard

TO replace the famous cutter BEAR which has a very enviable record of service with the U. S. Coast Guard and has long been an object of affection among those whose lives are spent in Pacific and Alaskan waters, the Treasury Department has decided to build a new Diesel electric boat. The BEAR is 51 years old and has been used by the Coast Guard for 40 years. She has a length of 198 ft., a breadth of 28 ft. 6 in. and a depth of 18 ft. 2 in., the displacement being 1700 tons. The new boat will have a length of 200 ft., a breadth of 39 ft. and a depth of 14 ft. 6 in. with a displacement of about 1900 tons. For driving the electric generators, use will be made of two 4-cycle, 6-cylinder Diesel engines of 600 hp. each, direct connected to 410 kw. generators and 75 kw. exciters. These will furnish power for a 1000 hp. double armature d.c. motor turning at 120 r.p.m. There will be two auxiliary engines for excitation and for auxiliary power purposes, these being 6-cylinder Diesel engines of about 90 hp., driving 60 kw. generators. For use in port a small auxiliary set of about 25 hp. will be employed. On deck as well as in the engineroom all the machinery will be electrically operated in line with the most advanced practice of operating economy.

Three 24 in. steel silencers for 2,500 hp. Sun-Oxford Diesel engines were ordered recently from the Maxim Silencer Company.

In order to take care of its enlarged activities the Cosulich Line of Trieste has decided to increase its capital from $6,000,000 to $10,000,000. (Rate of exchange taken as 4 cents per lira.) This is the company which has ordered the biggest motor liner yet contracted for.

Another vessel using the Burmeister & Wain type of trunk-piston engine has been placed in service. She is the SORVARD owned by Lauritz Kloster of Oslo, and is of 3673 tons gross with a deadweight capacity of about 7050 tons. She measures 367 ft. in length b.p., 51 ft. 3 in. molded breadth and 26 ft. 6 in. molded depth to the upper deck. Her propelling machinery consists of two 6-cylinder engines turning at 130 r.p.m. and equal to about 1950 s.hp.

Latest addition to the motortug fleet of the New York State Barge Canal, detailed on page 445

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Sketches and Working of Oil Engines*

Cylinder Water-Jacket Joints—Cylinder Stresses Due to Temperature Differences and Ways for Reducing Them

JUST as the study of sick persons frequently reveals to physicians important facts about healthy constitutions, so the faulty cylinder joint discussed at the end of the last chapter contains pointers for what may be regarded as typical of good practice. In packing the lower end of a cylinder liner against the cooling water one of the main considerations is that the "making up" of the joint shall not be contingent on an actual change in volume of the rubber used as packing material. In the joint illustrated in Fig. 58 the presence of the independent gland ring readily fulfills this condition; but as it is not always possible to provide such a ring, it is necessary to consider other methods of making slideable water-jacket joints.

A typical cylinder liner joint used for oil engine work is illustrated in Fig. 61 and depends on the use of round-sectioned rubber rings inserted in grooves. At *b* is shown the centering portion of the water jacket or frame in which the liner *a* is slideably held at its lower end. Cut into the latter are grooves *c*, shown enlarged at *f*, into which the round rubber is placed and out of which it protrudes as indicated at *e*. In order to prevent injury to the rubber the centering boss *b* is provided with the generous bevel shown at *z*. As a further safeguard for the rubber a lubricant to facilitate its entry may be applied.

Note that in addition to the groove *f* for actually holding the rubber there is provided the supplementary groove *j* into which the excess of the rubber *e* is displaced. It is hardly necessary to point out that the cross sectional area of the excess portion *e* must be less than that of the groove *j*. If that is not the case or if the supplementary groove is omitted altogether, the excess rubber will be simply sheared off irrespective of whether the bevel *z* has been provided or not. A sharp edge at that point will always encourage shearing off; but if there is no space into which the excess rubber can go it will be sheared off, bevel or no bevel.

Water-tightness is brought about by the pressure of the rubber exerted at *w* and at *g*, where the metal presses against the rubber with considerable force. The conditions there are essentially the same as those found to exist between the faces of an ordinary water-pipe flange shown to a smaller scale on the same sketch. It is the mechanical pressure exerted on the rubber gasket *s* by the bolts *t* which is primarily responsible for the tightness of the joint.

Joining the ends of the rubber—known to the trade as pure gum cord—is generally accomplished by means of ordinary rubber cement such as is used for patching automobile tires. No great care need be exercised in choosing the length of the rubber which is to be made into a ring; it is essential merely to see that it shall fit around the circumference of the groove with a moderate tension. In case the rubber is too large for the grooves as machined, its cross section may be reduced by choosing the length of the rubber cut off for the ring such that it must be considerably stretched in getting it on the liner. Too much stretching for this purpose is probably not to be recommended.

In cementing the ring joints a long scarf or bevel is to be recommended. Each of the ends is generally cleaned and sandpapered, after which each one is coated with cement separately and left to dry for a few hours. The actual joining is done immediately after applying a second coat of cement. Some engineers season the joint with cord as shown at *n*, although almost any way of uniformly clamping the halves of the joint together while it is drying would probably be satisfactory. Vulcanizing the joint at the engine factory with the aid of suitable apparatus would undoubtedly have advantages; on the other hand the strain to which it is exposed is not such as to require unusually careful procedure.

One ring such as that shown at *c*, if properly made, is ample to insure tightness; but in order to allow for imperfections in fitting it two and sometimes three are provided.

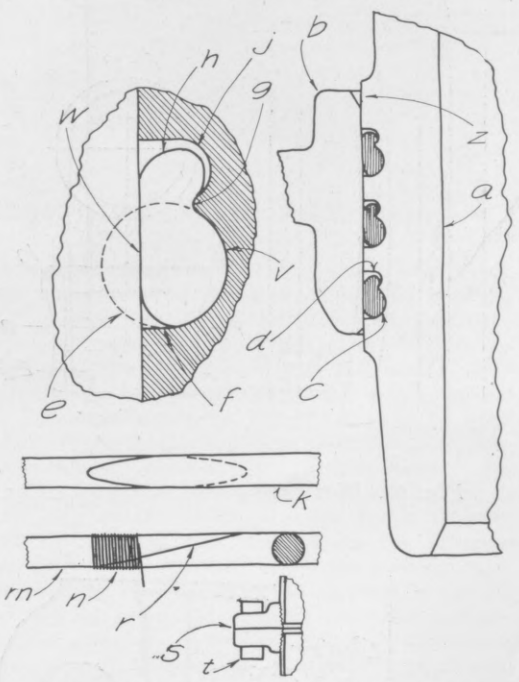

Fig. 61. Typical cylinder liner joint.

Further details concerning the cylinder head and the method of making the high-pressure joint between it and the cylinder will be discussed in the next chapter; a few additional details concerning the cylinder liner remain to be considered here. No claim is made of exhausting the subject in the condensed study which is being made in these pages; the types of oil engine details considered are intended rather to be samples of the kind of problem encountered in oil engine work. Outside of being chosen in such a way as to be as typical and representative is possible, the solutions worked out are intended to illustrate methods of attack rather than to serve as reference paragraphs out of a comprehensive oil engine handbook. Standardization in the manufacture and operation of oil engines has probably not progressed far enough at the present time to make the compilation of a reference book a profitable or even a possible undertaking.

Much research work on the transmission of heat through cylinder walls still remains to be done, but the information available to date is sufficient for the purposes of this study as above outlined.

The highest temperatures and pressures occurring in an oil engine cylinder are naturally found near the head end, particularly as the temperature peak has been passed by the time the piston has traversed about 1/10th. of its downward stroke. Referring again to Fig. 58 it will be useful to focus attention on that part of the liner situated just below the arrowhead *m* and to remember that this is about the region in which is found the most abrupt contrast between the furnace conditions on the inside and the cooling water on the outside.

Purely mechanical strain in that region may be easily arrived at by the simple calculation ordinarily employed for cylinders subjected to internal pressure. If the latter is represented by *P*, the liner thickness by *T* and the stress by *F* then

$$F = \frac{PD}{2T}$$

Ordinarily the thickness *T* is made about 1/12 *D* and the value assigned to *P* is frequently 500 lb. per sp. in. Substituting these values in the above expression we get

$$F = \frac{PD}{2} \times \frac{12}{D} = 6P;$$

$$F = 6 \times 500 = 3000 \text{ lb. per sq. in.}$$

Whether or not this is the actual stress in the cylinder wall may be questioned. Experience has shown, however, that liner thicknesses calculated in accordance with the above formula are suitable.

But that is by no means the whole story. Temperature differences between the inner and the outer surfaces produce stresses which add themselves to whatever mechanical forces are produced by the action of the gas pressure alone. While the inner layers of the cylinder tend to expand under the influence of the high temperature prevailing inside, the outer layers nearest the cooling water tend to retain their size. That is true not only of cylinders, but of all metal surfaces having the opposite sides maintained at different temperatures. In addition to the pressure stress as calculated above, the expansion stress must also be allowed for.

In Fig. 61 is shown an enlarged section of the cylinder wall which has been considered. Whereas the exterior is held at a fairly uniform temperature assumed to be 120 deg. F. the interior is subjected to the fluctuating temperatures of the cylinder gases. In a previous chapter it was observed that the central core of the gases may attain a temperature around 2900 deg. F., which is above the melting point of iron. The fact that oil engine cylinders actually do not melt and that it is possible to preserve an oil film on their interior surfaces shows that the metal does not begin to take on the gas temperatures.

Lubricating oils which disintegrate at temperatures between 600 and 700 deg. F. afford one clue to the interior surface temperatures reached, and experiments with thermocouples drilled into cylinder walls to various depths have yielded further information.

Experiments made with thermocouples on cylinders in operation have shown that there is a proportional rise in temperature as the inner layers of the cylinder are approached and up to a certain point the readings are steady showing no fluctuation in response to the varying gas temperatures. Close to the inner surface (Fig. 62) fluctuations begin to manifest themselves, becoming more violent as the drilled hole for the thermocouple comes closer and closer to breaking through. At *d*

*Summary of a course of instruction at the Polytechnic Institute, Brooklyn, N. Y., by Julius Kuttner, B. Sc., Licensed Chief Engineer, Associate Editor of MOTORSHIP. This is the sixth chapter, the first one having appeared in the January, 1925, issue.

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is shown what is perhaps the extreme high point of the temperature variation; it corresponds to that point in the engine cycle where the injection of fuel is most active and its combustion most intense. The temperature peak indicated at *d* is probably of extremely short duration as is evidenced by the fact that it does not generally cause any permanent damage to the metal surface. At *c* is shown the low temperature point corresponding roughly to the beginning of the compression stroke.

Some such line as *a-b* shows what the temperature gradient would be if the conditions were steady and may be accepted as the basis of a simple calculation by means of which the stress due to temperature causes may be estimated. To make such a computation accurately is a complex, and at best not altogether a trustworthy, procedure. The modest arithmetical exercise which is to follow is made not to give a precise figure for the stresses set up, but in order to throw a general light on the conditions surrounding the problem.

Let it be assumed that the interior diameter of the cylinder is 27 in. and for convenience that at 120 deg. the outer as well as the inner layers are 100 in. in circumference. If then the innermost layer is heated to 240 deg. or 120 deg. higher than the outer one it will increase in length by an amount readily calculable from the temperature expansion coefficient of cast iron. Every inch of this metal expands 0.00000556 in. for every degree that its temperature is raised, so that if a 100-inch strip were to be raised 1 deg. F. its length would increase by a little more than half a thousandth of an inch. With a 120 deg. temperature rise the total length of the strip would be elongated by 0.068 in.

Suppose that the inner and outer layers could be peeled off and placed between 100 per cent rigid abutments situated exactly 100 in. apart, as sketched in Fig. 63. The outer layer would go in without trouble as shown at *c*, but in order to get the inner layer into place it would be necessary to cramp it in some such fashion as shown at *d*. Since the layer is 0.068 in. too long it would ordinarily project beyond the abutment *b* as shown at *e*. Actually to get it into place so long as it has a temperature of 240 deg. would require a very considerable force, one which is equivalent in fact to the tension load required to stretch the outer layer from 100 in. to 100.068 in.

For the sake of illustration, then, let it be assumed that the inner layers actually succeed in stretching the outer ones by 0.068 in. How much force has been necessary to do it? If we are interested in the stress per square inch of cross section there is no need for assigning any definite size to the strip which we have assumed to be pealed off. There is a figure known as the modulus of elasticity which shows the relation between the stress in a metal and the elongation per unit of length which the stress produces. The figure may be applied directly to this calculation.

Knowing that

$$\frac{\text{Stress (per sq. in.)}}{\text{Elongation (per in. of length)}} =$$

15,000,000 for cast iron, it is a simple matter to multiply out and find the stress in which we are interested. The elongation per inch of length, as we have already seen, is equal to 120×0.00000556, and to produce this change in length a stress of $15{,}000{,}000 \times 120 \times 0.00000556 = 10{,}000$ lb. per sq. in. would be required.

No such stress is actually produced, of course, because the interior layers are cramped in expanding by the opposition of the outer layers just as much as the latter are extended by the bulging of the interior ones. Consequently it would be reasonable to assume that the 10,000-lb. stress is divided up and that the compression of the inner layers and the tension in the outer ones is equalized at a figure approximating 5,000 lb. per sq. in.

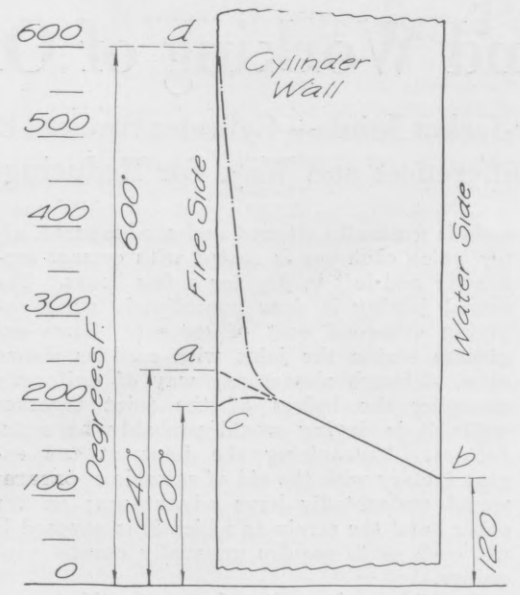

Fig. 62. Temperature gradient in cylinder wall

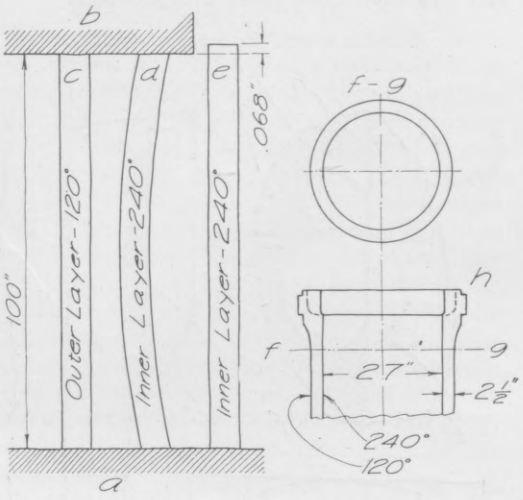

Fig. 63. Illustrating heat stress in wall.

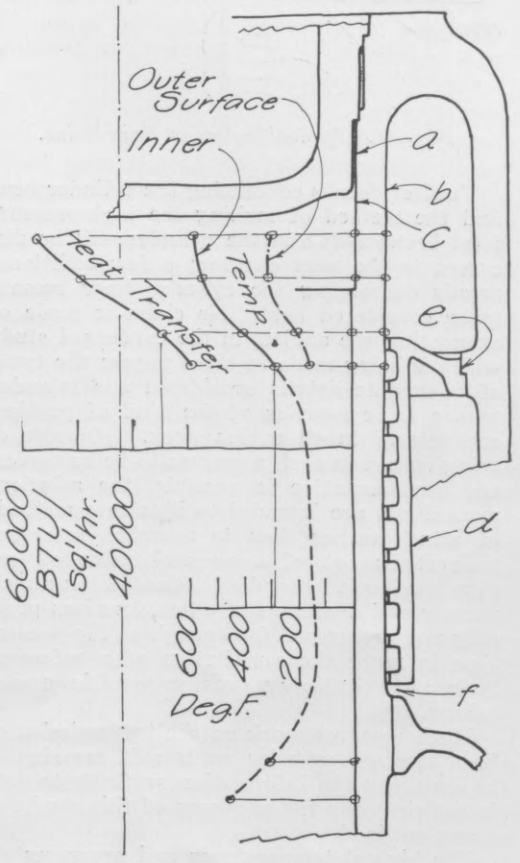

Fig. 64. Upper end of cylinder of double-acting engine, with heat diagrams

The 3,000-lb. mechanical bursting stress previously calculated represents tension and therefore tends to neutralize the compression present near the inner surface, whereas it intensifies the tension stress caused in the outer layers by the heat expansion. On the outer surface the total combined stress might therefore conceivably add up to 8,000 lb., and the fact that the ultimate tensile strength of good cast iron is well above 23,000 lb. per sq. in. probably explains why the failures are as rare as they are. The calculation here worked out admittedly represents an extreme case.

Attention is drawn particularly to the fact that it is the temperature difference which has a determining influence on the calculations and that the thickness of the liner has apparently had nothing to do with them. But such is far from being the case. The slope of the temperature gradient line shown in Fig. 59 is definitely determined by the amount of heat which must escape through the metal per unit of time and amounts to something like 25 per cent of the heat liberated by the combustion of the fuel. Varying the thickness of the wall does not materially affect the slope of the line; but as the wall thickness is increased the difference between the heights of the line on the water side and the fire side becomes greater. Thickening up the liner wall increases the total temperature drop, so that if it amounted to 120 deg. where the metal measures 2½ in. it would be 144 deg. at sections 3 in. thick. Had the figure 144 been used in the calculations, an even greater stress would have been arrived at.

Lack of understanding of this condition had something to do with a part of the failures that occurred in the earlier stages of oil engine development. Designers thought that cracks could be avoided simply by piling on metal and it was not until later that the need for reducing metal thicknesses to a minimum began to be understood. In the thinner sections the mechanical stress naturally runs higher, but the reduction in temperature stress often more than counterbalances it.

A comparison between Figs. 57 and 58 in the light of what has been discussed will be interesting. In the integral cylinder casting shown in Fig. 57 heavy metal sections are quite consistently avoided whereas a cylinder flange of great thickness is shown in Fig. 58. A good many cracks have in fact been developed in locations similar to this, and for the purpose of avoiding them designers have devised a variety of cylinders and cylinder heads. Little trouble is nowadays encountered with the design shown in Fig. 58 provided the cylinder diameter *z* does not exceed say 20 in.; but in the larger sizes having a flange thickness around 5 in. The heat stress is apt to become serious. A number of effective solutions have been found for the problem, chief among which are modifications of the cylinder head design. In some cases the head castings have been extended down a short distance in such a way that they form part of the cylinder while the actual liner barrel is attached by means of a flange partially or totally submerged by the cooling water. A more thorough study of these is to be made in the succeeding chapter devoted to cylinder heads.

An interesting solution of the cylinder-joint problem which may properly be treated in this chapter on cylinder heads is illustrated in Fig. 64, where the upper end of a double-acting two-cycle cylinder with port scavenging is sketched from a diagram which appeared in the *Zeitschrift des Vereines deutscher Ingenieure* on June 29, 1923. Owing to the absence of large exhaust and inlet valves from the cylinder head its structure is simple and allows the upper joint to be arranged almost entirely at the will of the designer.

It is readily apparent that the head projects a considerable distance below the joint-shoulder (*a*, Fig. 64) while the cylinder barrel *b* projects up above the corner *c*, a point which

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is about as far up as the fire due to the combustion can reach. Both the head casting *a* and the cylinder wall *b* are actively cooled by their respective water circulations with the result that the usual heavy accumulation of metal in the neighborhood of the joint is gotten rid of.

But the design sketched in Fig. 64 also illustrates another principle which appears to be increasingly recognized as an effective means for counteracting the heat stress, and that is the arrangement of the jacket spaces in such a way as to obtain high velocities of cooling water flow. The idea is by no means completely carried out in the design chosen for illustration; but the sharp contrast which it exhibits between those parts of the cylinder where the water flow is active and those where it is sluggish makes it possible to point the lesson all the more clearly.

Water flowing slowly over a metal wall the other side of which is absorbing high temperatures will pick up a definite number of B.t.u. per sq. ft. per hour and will suffer a rise in temperature inversely proportional to the amount flowing. It would be natural then to suppose that if the speed and quantity of the water are increased, its temperature will be lower in direct proportion to the distribution of the absorbed heat among the greater number of pounds of water per hour which pass over the surface at the increased velocity. Allowance is of course also made for the fact that the greater temperature difference encourages a more active transmission of heat from the gas to the inner surface of the wall, but this effect is probably counteracted partly by the fact that a lower inner surface temperature would tend to chill and stratify the layers of gas next to it and reduce the ability of the main body of heated gas to impart heat to the metal.

Researches have indicated that increasing the flow of water causes a greater abstraction of heat than can be accounted for simply in terms of the greater water quantity and of the greater temperature difference between the inner and outer surfaces. In fact it appears as though good cooling actually reduces this temperature difference. There is every reason for believing that the speed and turbulence of the water passing over the surface has a good deal to do with the specific rate of heat transfer between the wetted metal surface and the liquid.

At first thought it might seem as though too active a chilling of the outer cylinder surface would create just that temperature contrast which was seen to be so great a factor in setting up heat-distress. The mean temperature of the gases is probably not appreciably affected whether the confining walls be kept actively cooled or the reverse, and at the same time every degree by which the wall is cooled would therefore appear to set up just that much additional temperature difference between the outer and the inner surfaces.

This view is not entirely supported by the facts, the most important one of which is that the inner surface responds very actively to the exterior surface temperature. An inexact way of stating the case would be that every degree of temperature reduction on the water side causes two degrees drop on the fire side and that for every one per cent on the surface of the cylinder bore there is a three per cent reduction in the number of heat units transmitted per sq. ft. per hour. Many will undoubtedly find it difficult to credit the latter part of this statement. Probably the paradox is responsible for the attempt at explanation embodied in the theory that the combustion gases tend to be stratified in contact with the cooler metal surfaces.

Researches now in progress will undoubtedly clear up these questions in due time. From the point of view of the practical engineer it is important to note that a number of designers are beginning to act as though

Fig. 65. Special Cooling Groove

it were a good thing to abstract heat from the combustion walls of an engine as actively as possible and that some of the engines constructed by them show determined efforts to increase the turbulence of the water flow around the heated parts for that very purpose.

Referring again to Fig. 64 it will be seen that a special cooling water deflector *d* has been placed around the cylinder barrel. As the upward flow of the water is blocked at *e*, the only escape which remains for it is past the first of the ribs situated on the interior surface of the deflector *d*. Upon passing each succeeding rib the water as it rises is forced to flow at increased velocity over the surface of the cylinder. After emerging at the upper end of *d* it mingles again with the relatively still body of water present in the upper end of the jacket.

In passing it may be well to observe that the final outlet temperature of the water coming from the jackets of an engine is not an infallible guide to the highest water temperatures which have actually been attained. Locally the water may be heated above the boiling point while the resulting steam is re-condensed as it mixes with the main body of cooler circulating water.

In the sketch reproduced in Fig. 64 some of the observed cylinder wall temperatures as well as the heat flow calculated from them have been plotted. Thermocouples were located as shown and a record of their indications during the actual operation of the engine was made.

In studying the curves it must be borne in mind, of course, that the gas temperatures are highest near the ends of the cylinder. But even when this fact is duly allowed for it appears as though the effect of the heat shield is a pronounced one. Above the point where the heat shield ends and the flow of water becomes sluggish again the temperatures are decidedly higher than they are over the region covered by the shield.

The two temperature readings at the extreme end of the dotted curve found in the region of the exhaust belt where there is little or no cooling tend to controvert the view that the temperature drop shown by the curves as the lower end of the cylinder is approached might be due entirely to the expansion of the combustion gases.

Especial importance is attached to the fact that the two cylinder wall temperatures—inner and outer surfaces—appear to approach each other rapidly in response to the action of the heat shield. As they come closer together the rate of heat transmission, also shown by a curve, suffers a marked reduction, in apparent contradiction of what has been said in regard to the greater abstraction of heat by the more rapidly flowing water. No explanation for the paradox is available beyond the one already given, in accordance with which the reduced inner surface temperature is made responsible for the diminished interchange of heat between the combustion gases and the metal. Whether the colder metal actually causes a part of the gases to stagnate as non-conducting layers on the interior surfaces or whether something else is responsible for the reduced heat transfer would probably be hard to verify experimentally.

Keeping down temperatures is no doubt one of the ABC's of oil engine work and concerns the designer as well as the operator. Cooling water overflows from this class of machinery deserve the same unceasing vigilance that is accorded to the gauge glasses of steam boilers. Although "low water" in an oil engine will not generally devastate the immediate surroundings as it may do in the case of a boiler, it is capable of reducing the better part of an engine to junk in almost equally effectively.

Another way of securing active and well-guided cooling water flow around an oil engine cylinder is illustrated by Fig. 65. As the tops of the approximately helical groove are machined and fit with only a slight clearance in the machined bore of the jacket, the water is constrained to flow in a rapid stream through the resulting channel. The walls of the groove also add to the metal surface available for transmitting heat to the water.

Much the same effect is secured in the water jacket of the double-acting engine shown in Fig. 56, where a bell-shaped casting slipped over the cylinder barrel serves to confine the circulating water. Whereas it is flanged on at the top in the ordinary way, it is packed against the heavy cylinder retaining ring by means of a slideable joint not unlike the sample which was discussed earlier. The water cannot of course escape past the packed joint, and the only other path open to it is between the steel cylinder wall and the interior circular ribs of the water-jacket shell. The abstraction of heat caused by the increased velocity of flow is further intensified by the roughened surface of the steel. As in the previous example, the form of the metal is such as to increase the turbulence of the water and offer a larger surface.

Stress has been laid on this method for intensifying the effect of the cooling water because of the experimental data which appear to back it up and because its application to new designs seems to be spreading. It is making its appearance not only in connection with cylinders, but also in cylinder head designs, a study of which is to be taken up in the next chapter.

(*To be continued*)

Catalogs

Nobel Diesel Engines—a 16-page illustrated catalog of the marine and stationary types of Nobel Diesel engines. Svenska A.—B. Nobel Diesel, Nynäshamn, Sweden.

Correct Lubrication for Motorboat Engines—Recommendations for lubrication in marine Diesel engines, surface-ignition engines and gasoline engines. Vacuum Oil Company, 61 Broadway, New York.

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Review of Recent Publications

Libro Registro, 1925

By the Registro Navale Italiano e Veritas Adriatico. 9¾ in. x 7½ in. 879 pp. Price 200 lire (about 8 dols.) inclusive of monthly supplements. Published by the Registro Italiano, 2-10 Via Petrarca, Genoa, Italy.

This annual publication of the Registro Italiano contains the registered data of all ships and boats classified by the Italian Bureau, of all powered vessels under the Italian flag and of all other Italian craft exceeding 50 tons gross. It contains also a list of Italian shipowners and lists of different classes of vessels. All headings are given in English as well as in Italian. The arrangement of the data and the printing are excellent. This book is the most complete and authoritative record of Italian shipping.

Port Development

By Ray S. Mac Elwes. 9 in. x 5¾ in. 456 pp. Price 5 dols. Published by the McGraw-Hill Book Co., New York.

This book deals with port development from the economic, administrative and planning aspects. The author, a former director of the U. S. Bureau of Foreign and Domestic Commerce and now Commissioner of Foreign Trade and Port Development at Charleston, S. C., is well equipped by training and experience to deal with the subject. He has previously compiled a book on port and terminal facilities, which at the date of its publication was accorded wide recognition as a sound treatise, has been reprinted three times and is now being revised for a second edition. The first part of the new book on Port Development deals with the economics of ports from national and local standpoints, and comprises chapters on the growth of commerce, on the government agencies responsible for harbors and channels, on the relationships between ownership, control and operation, on advertising and on port planning. The second part considers the commercial use of ports and the influence of geographical and physical factors. A large part is devoted to analytical study of port competition as affected by the volume and character of traffic, railroad rates, ocean rates and terminal facilities afloat and ashore. The book concludes with a review of the free-port, its advantages and disadvantages, administration and service in other countries.

Oil Engine Power, 1924

Bound volume II. 11¾ in. x 8¾ in. 7½ dols. 340 pp. Published by Russell Palmer, 27 Pearl St., New York.

Back numbers of OIL ENGINE POWER will be difficult to obtain soon. Most issues during the last two years are completely out of print, and single copies therefore no longer available. The bound volumes for 1924 are $7.50 in cloth or $8.50 in half-morocco. A few volumes of 1923 are still available, bound in half-morocco, at $10. These two volumes, together with the several issues of this year, will give a reader a complete file of that magazine since its first publication.

Hilfsbuch für die Schiffsführung

By J. Müller and J. Kraus. Second edition. 9 in. x 6 in. 576 pp. Price 33 gold marks ($7.85). Published by Julius Springer, Berlin.

This treatise appeared first in 1911. The second edition just published is larger and has been brought up to date, including even an exposition of the theory of the rotorship. It is not a text book, but has more the character of the so-called handbooks known in engineering and marine architecture. One of the authors is inspector of the North German Lloyd and the other is Dean of the Stettin School of Navigation, and together they have compiled a work which deals not only with navigation but with seamanship, stowage, signaling, maritime law, and such general aspects of ship construction and machinery as a captain should be acquainted with. More than half the book is devoted to navigation and all its modern aids, treated in a very thorough and complete manner.

The Ports of Los Angeles, Long Beach, San Diego, and San Luis Obispo, California

Port Series 13. Prepared by the Board of Engineers for Rivers and Harbors, War Department, in cooperation with the Bureau of Research, United States Shipping Board, 9 in. x 5¾ in. 250 pp. 75 cents. Obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Although numbered thirteenth of the series this is only the seventh report distributed—the earlier ones have covered Portland, Me., Boston, Mass., Mobile, Ala., and Pensacola, Fla., Philadelphia, Pa., New Orleans, La., and Galveston, Houston and Texas City, Tex. The purpose of the reports is to present detailed information of practical value to vessel operators, producers, manufacturers, importers and exporters and others who are shipping by water. The War Department is required by law to assist the various ports in the design and construction of modern port terminals of such character as to handle the particular business of the port in the most expeditious and economical manner. It has therefore, to make thorough studies of the ports, and because these are made on a basis that is as far as possible uniform and is always impartial they serve as a sound framework for the reference books on ports now being published by the Department. The volume gives a general description of the ports, tides, tidal currents, anchorages, weather conditions, bridges and harbor and terminal improvements, port customs and regulations, services and charges, pilotage, towage, fire protection, lighterage, dockage, wharfage, loading and unloading, handling, storage, labor, bunkering, and ballast facilities, water supply, piers, wharves, ownership of water front and of elevators and storage warehouses, facilities for repairs and drydocking and full data on railroad and waterside communications. Numerous maps, plans and illustrations complete the volume.

The Ports of Portland and Astoria, Ore., and Vancouver, Wash.

Port Series 11. Prepared by the Board of Engineers for Rivers and Harbors, War Department, in cooperation with the Bureau of Research, United States Shipping Board. 9 in. x 5¾ in. 224 pp. 75 cents. Obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C.

This is the eighth of the series to be issued, and covers the northwest ports mentioned in the same way as the Port Series 13 reviewed above covers the south-west ports.

Personal Notes

Wm. T. Hayes, formerly United States S.B. port engineer at New York, has joined the Vacuum Oil Company as special engineer attached to the marine sales department. Mr. Hayes first went to sea as an oiler and worked his way up to chief engineer with unlimited license. He has had previous experience with Vacuum Oil products, having for a time been marine sales engineer for the Standard Oil Co. of California which markets Vacuum Oils on the west coast.

Eads Johnson, M. E., marine architect and engineer, has been appointed manager of the marine department of the Foamite Childs Corp.

J. Harry Mull, president and general manager of the Wm. Cramp & Sons S.&E.B.Co., Philadelphia, has been elected president of the Atlantic Coast Shipbuilders Association for the ensuing year.

Allen W. Morton has been elected vice-president and chief engineer of the American Hammered Piston Ring Co., Baltimore, Md. Mr. Morton has been with this company for five years, and many of the refinements of their products are the results of his efforts.

L. A. Taylor, well known among the industries of the Pacific Coast, especially for his wide experience with the application of Sharples super-centrifugal force, has opened a Pacific Coast office at 688 Howard street, San Francisco, on behalf of the Sharples Specialty Co. of Philadelphia.

Homer L. Ferguson, president and general manager of the Newport News S.B.&D.D.CO. and a former president of the Chamber of Commerce of the United States, will represent the American shipbuilding industry at the third biennial meeting of the International Chamber of Commerce in Brussels, Belgium June 21 to 28.

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